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VOL. IV WASHINGTON, D. C., MARCH-APRIL, 1924 No. 23

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Ordnance and Gunnery at the United States Military Academy

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ARMY ORDNANCE

THE JOURNAL OF THE ARMY ORDNANCE ASSOCIATION

Pledged to Public Service in Effecting Industrial Preparedness for War as Our Strongest Guarantee of Peace

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WILLIAM W. COLEMAN, *Vice-President*

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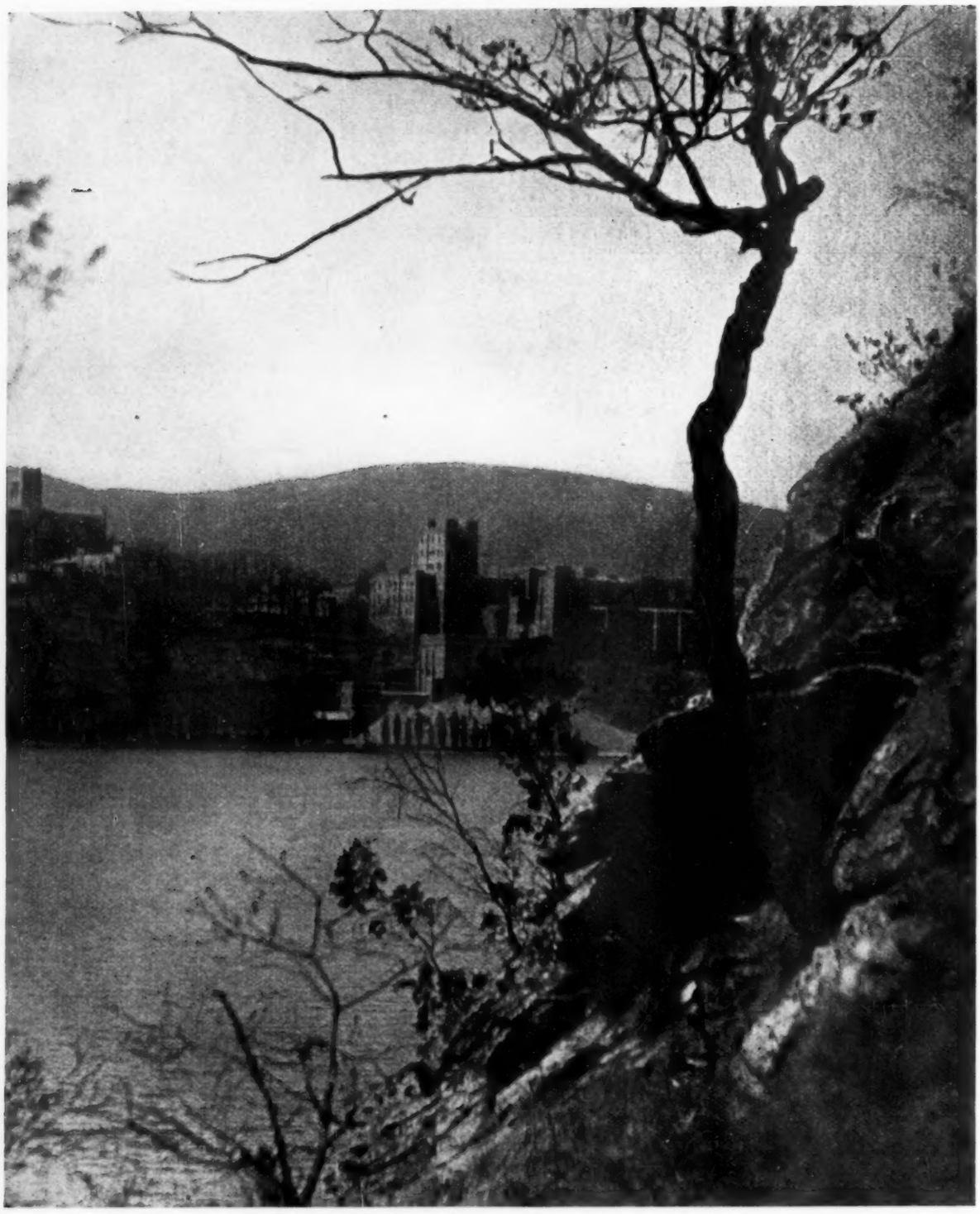


The United States Military Academy
West Point, New York

"A Symbol of the Military Strength of the Republic and a Promise for its Future"

Recommended by General Washington and by Alexander Hamilton. Established and Founded by President Thomas Jefferson on March 19, 1802. Reorganized and Developed by General Sylvanus Thayer from 1817-1833. Rebuilt from 1906-1924. Additional structures, already designed and located, are needed.

Editorials

Benedict Crowell: A Vindication

MR. BENEDICT CROWELL needs no introduction to our readers. He has served as President of the Army Ordnance Association since its foundation and has been unsparing of his time and energy in promoting the cause of adequate industrial preparedness. Under his leadership the Association has grown to its present size and has accomplished much for the cause for which it was established.

In view of what follows, it is well to point out to our readers that Mr. Crowell has never dictated in any way the editorial policy of this journal. Like all other members of the Association he knows the contents of each issue only when he receives his copy in due course. This present issue and this editorial in particular are no exceptions.

Mr. Crowell was recently vindicated by the Supreme Court of the District of Columbia of certain charges concerning his official conduct as Assistant Secretary of War during the World War. The charges when originally made were broad-casted from the house tops. And thus irreparable harm was done a conscientious and broad-minded citizen who in time of need performed a great public service at the sacrifice of his personal interests. It is our desire to give the widest publicity to his vindication.

We do not care to criticize those who brought the charges; this phase of the matter is amply handled by Mr. Justice Hoehling, who riddled the indictment in his analysis of it. We call attention to the almost universal expressions of respect and admiration by press and people for Mr. Crowell, his excellent war service, and his continued interest and efforts for national defense

Mr. Crowell himself said soon after the charges were brought: "It is not in human nature that a man given the opportunities for service that were given to me in the time of the country's need could have devoted those two years in cold blood to cheating and wounding the nation for his own miserable profit." In the words of the *New York Times*, "Mr. Crowell and his associates were indefatigible in their energy and devotion to the Allied cause." *Chemical and Metallurgical Engineering* had this to say, "Engineers generally should spread the facts in this case so that no unwarranted stigma will remain on the reputations of engineers who turned their professional talents to such good account during the war." *The Iron Age* said, "To those who have long known Mr. Crowell's honorable record in the iron ore trade and in other businesses this decision was not less than had been expected. It is a satisfaction to have from this high source such a vindication of men who won the gratitude of the nation by their splendid work in getting troops and munitions to France against tremendous obstacles." And we might quote similar comment from many other sources.

To us it seems a sad commentary on our American sense of fair play when men who give unsparingly and patriotically of their talents in time of war are wantonly accused and unjustly criticized. If this be the price of public service, little need we wonder should responsible men in future withhold their active cooperation even in time of peril.

Mr. Crowell's vindication is complete. His friends knew this from the first. His accusers have been vanquished before the high tribunal of justice. Conscious of the task that is yet to be done, he continues his good work for adequate national defense.

The President Approves Preparedness Plans

TELEGRAM

Washington, D. C.,
Feb. 5, 1924.

Hon. Elbert H. Gary
856 Fifth Avenue
New York, N. Y.

I have just received a telegram concerning the gathering of engineers tonight to hear the Assistant Secretary of War, Mr. Davis, discuss industrial preparedness as insurance against war. I am glad to know that the engineers who in such a matter can make one of the very greatest of possible contributions are so deeply interested and that they are prepared to cooperate. There can be no doubt that Secretary Davis' message presents a practical and highly constructive proposal which looks to the insurance of peace.

CALVIN COOLIDGE

Man Power and Munitions Power

THE greater portion of this issue of ARMY ORDNANCE is given over to descriptions of the United States Military Academy. We hope that our readers will find the various articles of especial interest. The Academy is the great plant where military leaders are moulded and formed. Here our officers—past, present, and future—receive that training which has always been and will always be a source of national pride.

As members of the Army Ordnance Association the great objective to which we are pledged is adequate munitions power. We believe that the man power problem—if it can still be considered such—is solved. Under our present triune Army organization with *one* army fuzed from *three* components trained men in numbers will always be available. It is the question of munitions, the problem of adequately equipping those men with the right weapons at the right time, that needs emphasis and to the necessity for which the public mind must become accustomed.

But man power and munitions power must go hand in hand. West Point is the key-stone of the man power arch. It therefore behooves us to give some thought to this great

institution, its work, its methods, its aims and its needs. West Point should be known and understood by every American citizen. To promote such knowledge and understanding this issue of ARMY ORDNANCE is dedicated to West Point.

Western Division, Chamber of Commerce, Approves Preparedness Plans

ANOTHER influential organization has joined the ranks of industrial preparedness advocates! The Western Division of the United States Chamber of Commerce at its mid-year meeting, January 29, 1924, at San Francisco, approved the industrial mobilization plans of the Government and recommended to the national body, the United States Chamber of Commerce, that support and assistance be given the War Department in carrying the project forward.

The resolution as adopted reads:

"The Western Division of the United States Chamber of Commerce indorses the policy of preparing plans in time of peace looking to the mobilization of industry in time of war, and recommends to the Board of Directors of the United States Chamber of Commerce that support and assistance be given to the War Department in carrying out plans now being formulated looking to a more efficient mobilization of industry in the event of war."

Certainly the signs of the times are that our people see the logic of "peace insurance." The number of its followers grows larger each day.

The Pistol Traffic

AT this writing, there is about to be introduced in the New York State Legislature a concurrent resolution sponsored by Assemblyman Louis A. Cuvillier calling upon the United States Congress to enact a law for Federal control of the interstate traffic in firearms.

Mr. Cuvillier has been opposed to the Sullivan Law since its enactment. He was a member of the New York Legislature in 1912 when "Big Tim" Sullivan's law was passed. Mr. Cuvillier opposed the Sullivan Law then; he opposes it now. Cognizant of the crime that has been rampant during recent years, he sees no panacea in any local measure which prohibits the carrying of arms without an individual permit. The criminal will go armed in spite of such a law and his supply of arms is assured because there is no way at present to check that supply at the source. The Assemblyman would therefore invoke one power under the Constitution, the interstate commerce clause, to nullify another, the right to keep and bear arms, upon which latter the Federal Government is explicitly forbidden to infringe.

Be that as it may, the question always bobs up: Is the game worth the candle? The trouble is obvious enough but we don't seem to want to cure it in the most obvious way. Why not beat the criminal at his own trade? Or, failing in that, let our Courts deal with him pitilessly and relentlessly, as is done in England. Let there be one and only one price for murder; throw technicality to the winds; let the transition from crime to gallows be *quick and sure*. And then watch the criminal statistics curve dwindle away.

Mr. Assemblyman, we offer the suggestion—as it has been offered time and time again—you can't make bad men good by law. Criminals must be met on their own terms and given their own medicine. We agree, this is a homespun doctrine, but it stands a better chance of eradicating evil than more laws that are impossible of enforcement.

Who's Who In This Issue

The articles on the United States Military Academy in this issue of ARMY ORDNANCE were written by members of the Department of Ordnance and Gunnery at West Point.

MAJOR CHARLES G. METTLER, who writes on "The United States Military Academy: The Value of Its Training," is a graduate of the Military Academy, Class of 1906, and has been Professor of Ordnance and Gunnery since 1920.

"The Academic Work at the Military Academy" is by MAJOR HUBERT G. STANTON, Class of 1911. Major Stanton, has been Assistant Professor of Ordnance and Gunnery since 1921.

MAJOR ROGER TAYLOR, whose article on "The West Point Museum" contains an excellent description of the historical exhibits at the Academy, has served as an Instructor in Ordnance and Gunnery since 1922.

"The Military Training of a Cadet at West Point" is by MAJOR OSCAR GATCHELL, a graduate of the Class of 1912, who has been an instructor at the Academy since 1921.

LIEUTENANT BEVERLY ST. G. TUCKER, who describes the course in ordnance and gunnery, is a graduate of the Class of 1918. He has been a member of the instruction staff during the past year.

MAJOR ROBERT N. BODINE, who writes on "The 29th Ordnance Company at West Point," is a graduate of the Class of 1912 and has been in the Department of Ordnance and Gunnery since 1922.

The paper on "The Physical Training of a Cadet at West Point" is the contribution of LIEUTENANT COLONEL H. J. KOEHLER, who was connected with the physical training of the cadets for forty years. Colonel Koehler's work at Plattsburg and in the training camps during the World War is well known. He occupies a high niche in the physical training world.

MAJOR WILLIAM A. BORDEN presents in this issue Part II of his paper on "Bombs." Major Borden, who was formerly Chief of the Aircraft Armament Division, Office of the Chief of Ordnance, is now engaged in bomb development at Aberdeen Proving Ground. Part III, which will conclude this treatise, will appear in the May-June issue of ARMY ORDNANCE.

DR. J. L. SHERRICK, formerly of the Bureau of Mines, presents in this number his second paper on explosive investigations: "The Influence of Confinement on the Explosibility of Ammonium Nitrate." His third article, "The Influence of Density of Packing Upon the Explosibility of Ammonium Nitrate," which will conclude the series, will be published in the May-June issue of ARMY ORDNANCE.

"Army Ordnance" a Month Earlier

Beginning with this, the March-April number, ARMY ORDNANCE will be issued on the first of the bi-monthly period instead of on the first of the second month of the period as heretofore. This change of procedure will in no way affect the periods for which the magazine is issued; it simply means, for example, that this number, instead of being issued April 1st, is in the mails March 1st; the May-June number will be mailed to be in the hands of readers May 1st instead of June 1st, and so on.

Erratum: The legend under illustration on page 284 of this issue entitled "General Sylvanus Thayer," states that General Thayer was Superintendent of the United States Military Academy from 1817 to 1863. This is incorrect. General Thayer acted as Superintendent from 1817 to 1833.

Foreword
The United States Military Academy

By

MAJOR GENERAL F. W. SLADEN

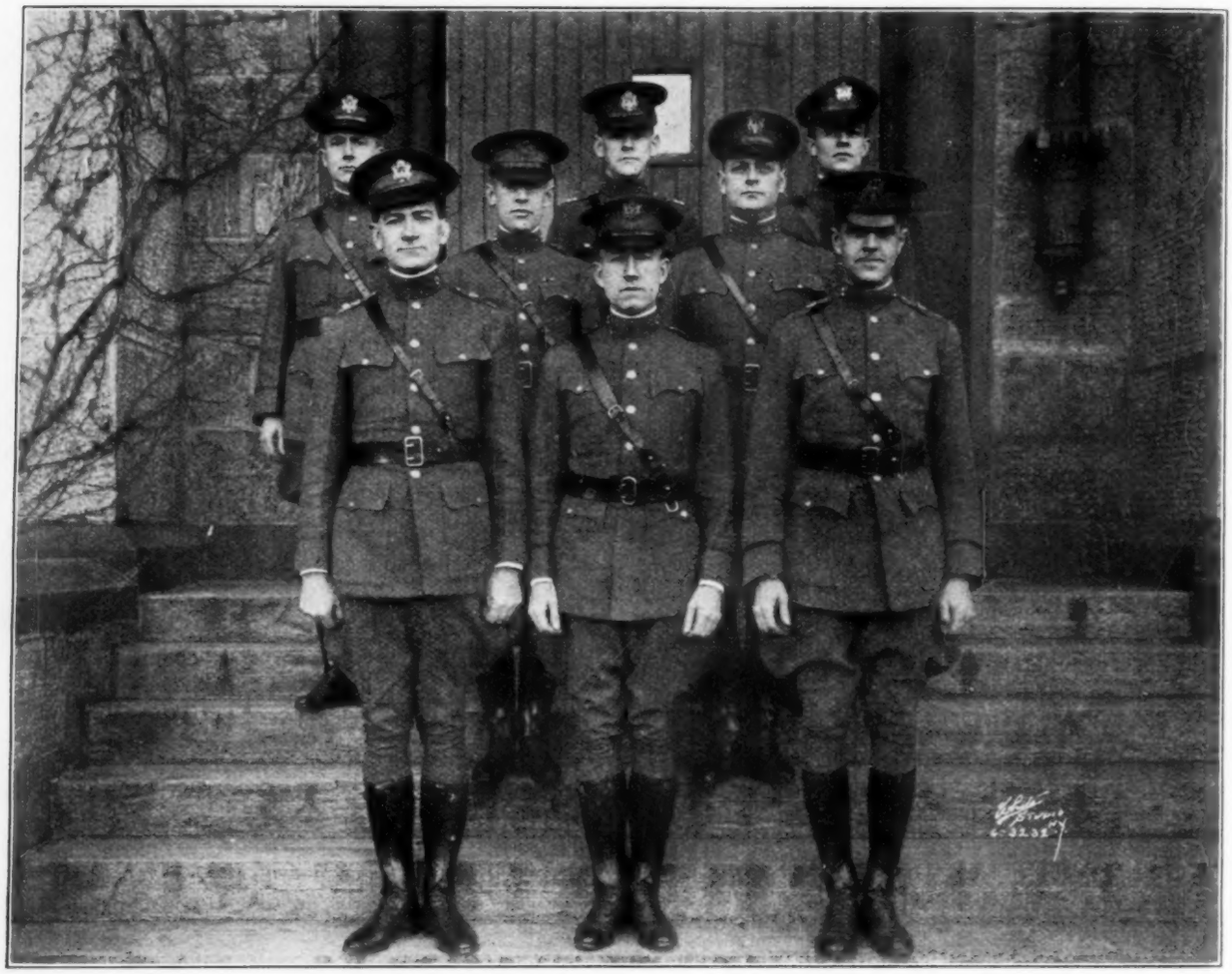
GENERAL SLADEN
Superintendent, United States Military Academy

THE place of the Military Academy in the scheme of national defense can very well be emphasized to the technical branches of the whole army, Regulars, Guardsmen and Reserves. Their interest will naturally turn to the facilities for technical education and the efficiency of that part of the course.

The interest in the spectacular side of the work has greatly increased in the last few years. The new highways along the Hudson river and through the adjacent Bear Mountain Park bring thousands of automobiles to the parades and reviews. An almost continuous line passes through the post on Sundays and holidays. The two railways and the river boat lines fill the grounds with interested sightseers throughout the summer and fall. There is no doubt that the fine military work of the corps, the attractive grounds, natural scenery and the historic trophies and structures afford much pleasure to those who visit here. What buildings we have are constructed so splendidly and in such fine architectural harmony that they give an impression of thoroughness and completeness.

The accurate drills would indicate adequacy of training facilities. It is very hard to say to our visitors that the barracks are overcrowded, that the mess hall is antiquated and inadequate, that the only social recreation hall is unable to take care of the social life of the corps, that the hotel is ancient and unsatisfactory, that no armory exists for winter and stormy weather drills, and that no suitable engineering laboratories are available. In these times of economy, of reduction of national debt, and of restriction of military expenditures, the Academy is making every effort to get the most out of its facilities, but its officers are aware that the shortcomings of today will be felt in the long and distant tomorrow when today's cadets take their part in handling the national defense. The publication of the following papers in this number of ARMY ORDNANCE should enlist the interest of munitions engineers in this officer-apprentice school and by so doing should tend to improve its value toward the insurance of the future of our country.

Ordnance Faculty at West Point



Faculty of the Department of Ordnance and Gunnery at the United States Military Academy, 1923-1924

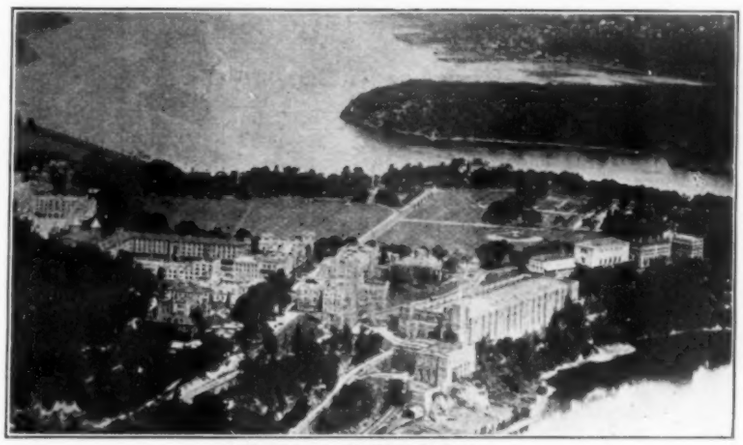
Those in the picture from left to right are: Front row: Major Charles G. Mettler, Ord. Dept., Professor; Major Hubert G. Stanton, Ord. Dept., Assistant Professor; Major Robert N. Bodine, Ord. Dept., Instructor.—Middle row: Major Arthur W. Ford, Ord. Dept., Instructor; Major Oscar J. Gatchell, Ord. Dept., Instructor.—Back row: Major Roger Taylor, Ord. Dept., Instructor; Captain John H. Cochran, C. A. C., Instructor; and Lieutenant Beverly St. G. Tucker, Ord. Dept., Instructor

The United States Military Academy
The Value of Its Training

By

C. G. METTLER

THERE are abroad a great many misunderstandings of the purpose of the Military Academy at West Point, a considerable amount of ignorance as to its methods of work, and perhaps, too, some doubts as to its value to the nation in the minds of those who do not know its history. Questions have been asked as to the expenditure of twelve or fifteen thousand dollars for a West Point officer, when the country could obtain from its colleges and universities, officers more extensively educated than its West Point variety, for no other cost than the effort to hold an examination. Inferences have been offered that the West Point officers form a positive school of thought, that they are intolerant of other methods and ideas from other sources and that they delay general cooperation and connected effort toward a comprehensive national defense.



A Panorama of West Point

In giving a thorough apprentice course of four years in Army training at the formative period of a man's life in producing a journeyman officer at the age of manhood, and in starting that worker into his profession with high thoughts and purposes, is known to be worth more than the expenditure of funds and energy. It is the purpose of this number of ARMY ORDNANCE to present the West Point idea so completely to our ordnance engineers, executives, and their friends, that there will be no need to combat the criticisms which have been made. It is the intention of this paper to present a part of the extra-curriculum influence of West Point which tends to produce a very acceptable type of intellect for the care of the nation's defense.

A clear presentation of the whole West Point effort to produce a good army officer should enlist the support of all friends of the Army and should awaken an interest which can only give profit to the Military Academy and encouragement to its friends.

The Army Organization

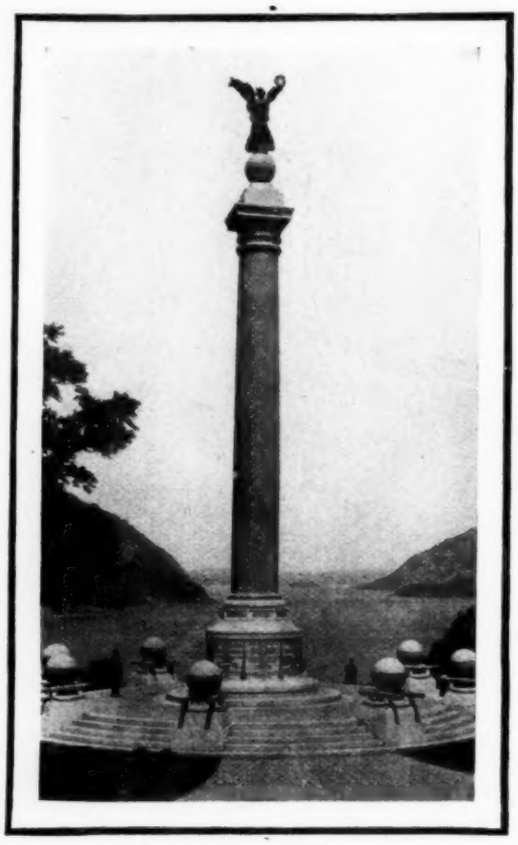
To understand West Point, it is essential to have a thorough understanding of the National Defense under its present organization and plans. For the purpose of organization and training for war, the United States Army is divided into three parts, one of which is the Regular Army, another the National Guard, and another the Organized Reserves. All three parts are organized in exactly the same manner and may be grouped together without any interference into divisions, corps and armies. They differ in the degree of training for war imparted to the individuals and organizations; the Regular Army being constantly in training on active duty; the National Guard being called into active service for training in the field once each year; the Organized Reserves having some training in summer camps each year for its officers only.

All parts have two distinct groups: one known as commissioned officers, the other as enlisted men. Both groups are required to be physically able to undertake hard field service and to withstand the rigors of war. The officers are, in general, required to have the equivalent of a college education, a good general knowledge of the fundamental principles of science and the arts, the ability to lead men and to direct their activities in large bodies, either in the military groups for field service, or in the commercial groups for the production and distribution of munitions. The enlisted men may be drawn from all branches of society and need have no other educational qualities than the ability to read and speak the English language.

In the Regular Army, an additional group, known as the cadet group, is provided for by law as a training corps for Regular officers. This group is stationed at the Military Academy at West Point, New York, and is organized as the Corps of Cadets. Its course of instruction covers four years, a new class of cadets being admitted each year and a trained class graduated. Only fifty or sixty per cent of those who are admitted to this corps complete the full course of instruction and become officers. The failures are due principally to inadequate academic preparation for the rigid and high requirements for advancement, or to lack of adaptability of the cadet to the demands of mili-

tary life. Those who pass the final test are graduated from the Military Academy and if found satisfactory for promotion are appointed second lieutenants in the Regular Army.

Appointments of second lieutenants in the Regular Army are made each calendar year, first from the graduated class of the United States Military Academy, then from the enlisted candidates who have passed the required examinations and lastly such vacancies as remain are filled as far as possible from civilian candidates completing the examination requirements. Out of a total authorized strength of about 1,330 cadets, the Military Academy secures from its candidates about a sufficient number each year to keep the corps slightly over 1,200 cadets. With this strength, the average class now graduated each year should be about 225. In case the casualties of the year do not provide sufficient vacancies in the Regular Army to absorb all the graduates of the Academy, they may be commissioned as additional second lieutenants until their vacancies occur. Under past conditions of army casualties due to the Spanish War and the World War and to the expansions following those wars, less than 30 per cent of the present officer cadre was graduated from the Military Academy. With the present graduation rate of the Academy, and the low vacancy rate expected within the Army during the next few years, this percentage will be gradually increased.



Battle Monument

Erected to the memory of the Regular Army in the Civil War. The shaft is surmounted by MacMonnies' "Victory"

Duties for Which Cadets Are Trained

The national defense scheme contemplates a small regular army sufficient to preserve domestic order, to garrison overseas possessions, and to provide a corps of officer instructors for the National Guard and Organized Reserve. The approximate relations of the three units are intended to be: Regulars, 300,000; National Guard, 600,000; Organized Reserve, 900,000. The Regular Army is subject to frequent change by the action of Congress and has lately been reduced more than half its intended strength. It is expected that a return will be made to the permanent plan of national security within a few years.

Under the above plan, the Regular officer is required to promptly obtain his military training and to assume his position as a leader of troops, as a teacher of the National Guard and Reserves and, in many cases, also a procurer and distributor of munitions. To successfully cope with this task, he must be a well educated citizen of the country, interested in its history and in its future, cognizant of the problems of the day and able to meet on common ground the people he must teach and whose interest he must enlist in national defense. He must be able to house, clothe, feed and entertain his enlisted men; teach them the military maneuvers to reach and attack an enemy; instruct them in the operation, care and maintenance of their arms; train them to build roads, construct bridges, dig entrenchments, erect fortifications, operate railways, drive motor vehicles, and perform numerous essential things to move forward a plan of campaign. One may readily learn to do the routine drill for the movement of troops but the knowledge required to meet in advance the usual things of war, to have a clear solution in an emergency, to be able to give the new temporary officers the correct instructions to insure their full support, is the requirement of the Regular and comes to him only through constant service and hard study. Less than forty per cent of the United States Regulars reached France before the armistice of the World War, because they alone could be counted prepared in even a small way for the great effort to be made and were able to find out quickly how to assign and use the training of their countrymen in an effective way. This work is in many ways the work of an engineer in the broadest meaning of that word.

Cadet Training

A few years ago a distinguished educator was engaged by the War Department to study and advance its educational plans. Assuming the duties of officers to be mainly those of engineers, he inquired of some hundred employers of college graduates as to the schools which produced the most satisfactory engineers. To his great surprise, the Military Academy stood out very prominently in the replies to his inquiries. Asking again of the same men as to the essential qualities they demanded of good engineers, he found them listed about as follows: courage, honesty, loyalty, initiative, application, patriotism, common sense, education, etc. The surprising part of this survey is the low place among the essentials which is given to education. So much of these qualities as is imparted to the cadet during his service at West Point, is due to careful selection, elimination, inspiration and discipline.

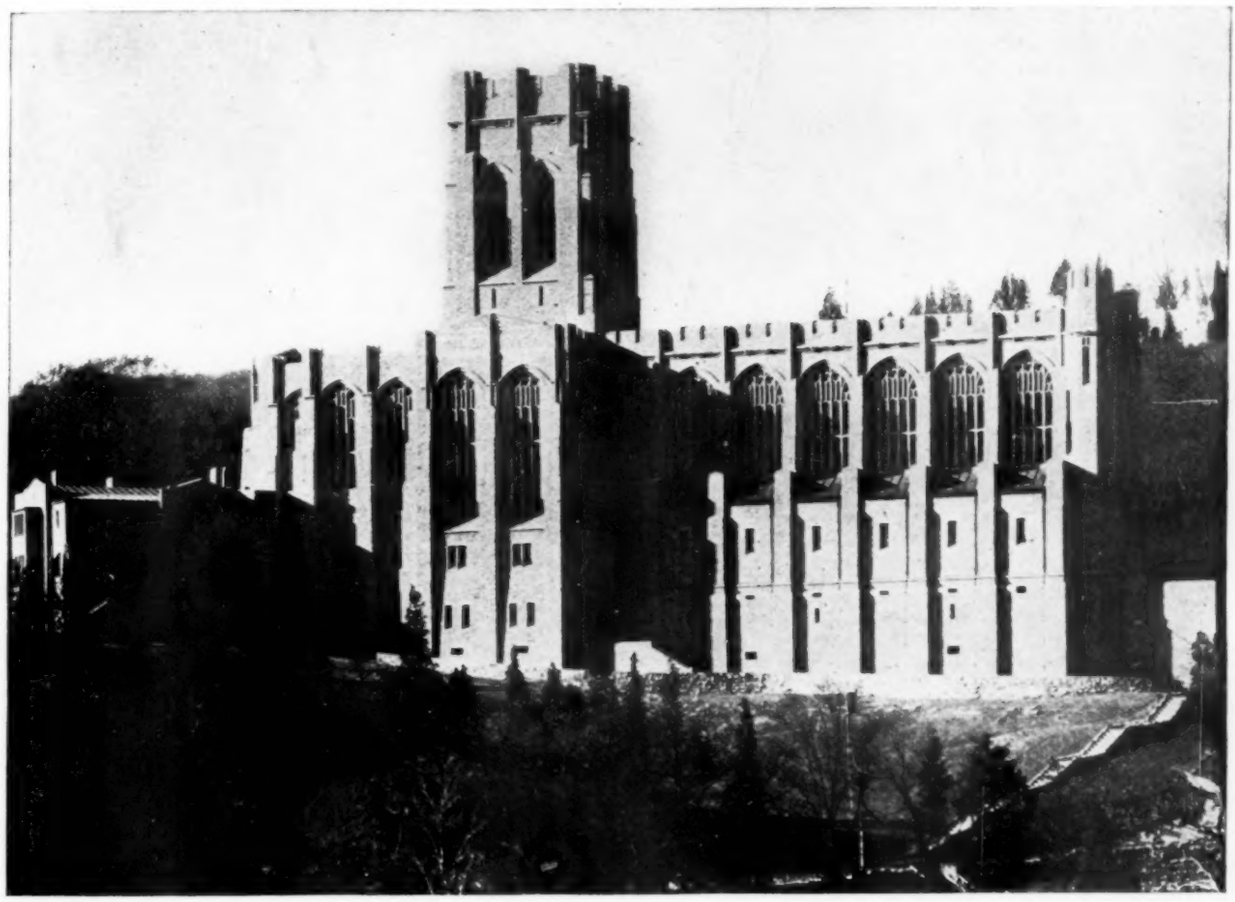
The academic staff at West Point has nothing to do with the appointment of candidates for the rank of cadet in the United States Army. This is done in the War Department upon the recommendation of the President and of Representatives and Senators of the National Congress. The Presidential appointments are generally made from the government services and from families which have little opportunity to secure Congressional appointments. The principal source, however, is the designation of candidates from the states and congressional districts by the members of Congress. Each may have two cadets at West Point for each of which positions they present two or more candidates to the War Department when vacancies occur. The Academic Board of the Academy provides the entrance examination for these candidates,

grades their written papers and designates those who have satisfactorily passed the requirements and selects those for whom vacancies exist in the corps.

The entrance requirements to West Point are about the graduation requirements of the public high schools of all parts of the country. If they were raised a great number of districts would have difficulty in filling their vacancies and the corps would be developed from the districts more advanced in educational facilities. The wide distribution

Those who are inclined toward other professions, who find themselves disinclined to pursue military studies, are allowed to resign and develop their lives in accordance with their own conception of their life purposes in other places. While a man is a cadet, he must play one game, and the object of that game is a touchdown behind the goal post of military life.

This singularity of purpose, this definiteness of the goal, and the high character of the reward for satisfactory work



The Cadet Chapel

The windows, of magnificent stained glass, are the gifts of the graduates. The organ, when fully installed, will be the most complete in America. The architecture in this splendid setting is truly "frozen music"

eliminates sectional feeling and tends to strengthen national sentiment.

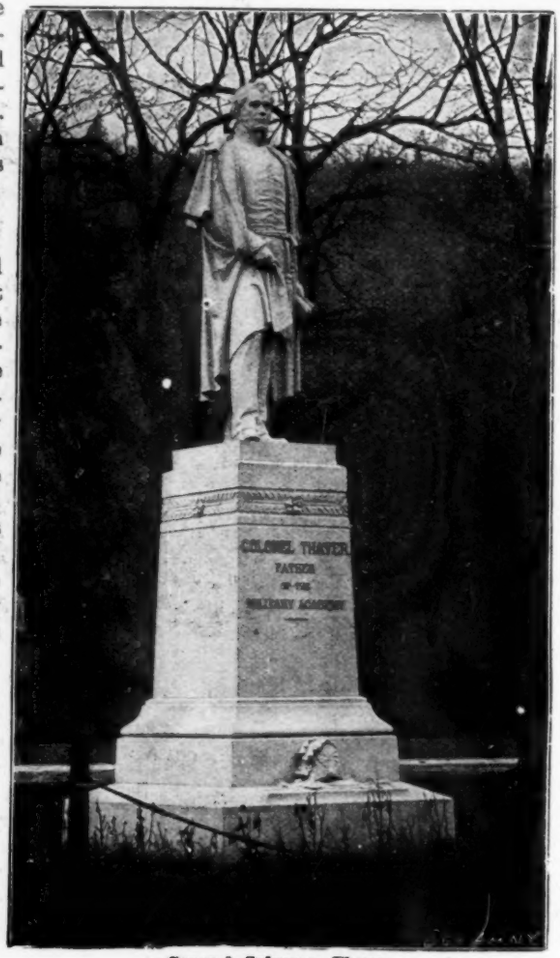
The examinations in the high school subjects are very thorough however and the passing mark is kept high to eliminate the unprepared and the careless student. The physical examination throws out most of those who are unfit for the physical strain of the course of training or unsuited for military life. Those who enter the Academy on July first each year should be mentally and physically prepared to carry the full work of the Academy without undue strain.

West Point is not a public school It does not offer to educate all who apply nor all who enter any more than our colleges and universities. In its elimination, it applies an additional test to the usual college academic tests; a requirement that the cadet must show fitness to command and lead men. It offers only one course. It gives no degree. There are no electives. It attempts to prepare its students for one task—the profession of arms.

are great advantages in securing attention and interest throughout the academic instruction. The government pay which is adequate for all necessary expenses eliminates the worry of financial support on the part of the student. The restriction of the limits of travel to the boundaries of the military reservation during instruction days prevents the diversion of the mind to disturbing influences. The absence of money in the barracks keeps down petty jealousies of financial power. The blacksmith's son is at no monetary disadvantage as a room mate of the son of a millionaire. Each one stands upon his own personal value. Distraction from the main issue of military education is eliminated in every possible way consistent with keeping in the cadet's mind an appreciation of life problems.

The mental and spiritual superiority of one cadet over another under these conditions is revealed during the first six months. This is generally apparent to the cadets themselves. Those who feel their inferiority in this peculiar life and see little hope of ultimate success submit their

resignations during the first half year. The examinations reveal the failures in December and they are discharged. The June examinations at the end of the first year catch those who have been overstuffed for the preliminary courses and have not the native ability to carry on. At the end of the second year nearly all of the unsuitable or academically weak students have been eliminated and the remaining two years are aimed to develop the classes for their all-around education required by military life. The examination standards are high. The military requirements are carefully balanced. The physical side is considered in fair proportion to other attainments. The final product has had much careful consideration before it is stamped and passed.



General Sylvanus Thayer
"The Father of the Military Academy." Superintendent of the Academy from 1817 to 1863 during which time he reorganized the school and established its present system

Inspiration of Traditions

Ability to meet academic and physical requirements does not always make a leader. There are many more or less intangible things that aid to build the spirit of the soldier. Throughout the one hundred and twenty odd years of existence of the academy, succeeding classes have built up a tradition about a cadet. This tradition decrees that he stand upon his own metal without credit for the deeds or rank or wealth of any ancestor; that he prove his worthiness for social recognition by a year's apprenticeship in the corps; that he rise to social, military or academic distinction in the corps by his own personal efforts honestly applied; and that he be responsible that this tradition is handed on with accuracy to those who follow him. Numerous small observances are included in the code of conduct which serve to strengthen character and to insure a high standard of life. The four words, Duty, Honor, Country, West Point, which appear on the academy crest, are impressed upon each cadet at the very beginning of his career. They appear over the entrance to the Academy, over the sally ports of barracks, upon the academic halls, and on the chapel windows. They are sung in the Alma Mater song in the chapel service and on festive occasions. As nearly all the officers are graduates, these words form part of the whole life of the place and increase their influence with each new class. High ideals cannot fail to be encouraged by four years of this influence.

Inspiration of Local History

The splendid historical association of West Point in the stirring days when national independence was won, is a factor contributing toward high morale. Constitution Island, across the Hudson, was the first fortification to resist the British attempt to cut off New England from New York to Canada in 1777. When Sir Henry Clinton sailed up the river to meet Burgoyne coming from Canada, he outflanked these early forts and the colonials were forced to abandon them. The island, through the courteous assistance of Mrs. Russell Sage, was deeded to the United States by Miss Susan Warner as a part of the West Point Reservation, and the old forts and camp sites thereon are being preserved and restored by the patriotic Martellaer's Rock Association. A cadet does not miss the inspiration of this early effort.

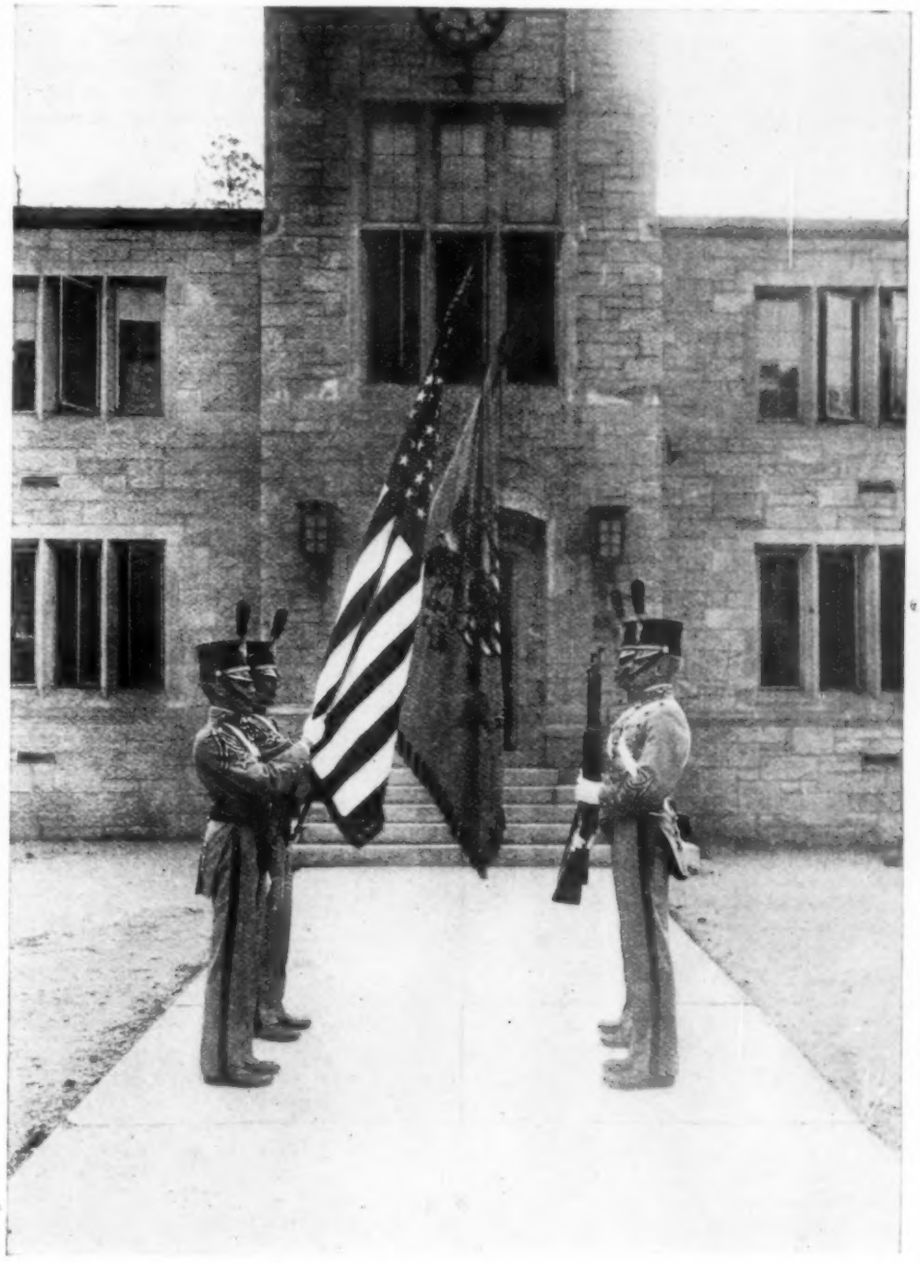
When Burgoyne was captured with his army in October, 1777, Clinton fell back to New York for the winter, abandoning the weak fortifications at Constitution Island. Washington at once sent able engineers to devise means to hold this part of the river against another advance and to hold the line of communications with New England at Newburgh. The engineers at once saw that West Point could be readily made the impregnable key to the north. They had a huge iron chain made and stretched across the river in the early spring of 1778. Pieces of this chain are kept on Trophy Point suitably labeled for all cadets to see.

A circle of fortifications of the most approved type of the day were rapidly erected on the plain of West Point and on its surrounding hills. All these old military structures have been repaired or restored and their history inscribed upon them. At evening parade, the whole line of cadets look toward the gray stone mass of Fort Putnam, crowning the height west of the post. Their summer camp is pitched on the parade of old Fort Clinton. Their finest walk passes the water batteries and the landing place of the great chain. Their riding trails through the great forest visit the redoubts and small forts of the western hills. A tablet in the old chapel reminds them that the place, untakable by force, was sought by the treason of Benedict Arnold. The monuments of Washington and of Kosciusko recall the high character of leadership required in these great days and inspire resolutions of great service. These things speak loudly and daily to the present cadet. They speak of heroism, patriotism, devotion to duty. They speak to him of suffering in the long hard winters, of an astonishing amount of daily toil with simple tools and bare hands; and of a cause, which his oath of service reminds him to protect with his life when its sanctity is threatened.

The United States Military Academy itself came about in the early days of the national life upon the earnest recommendation of General Washington and his successors that some place be provided to train young leaders for defense. On March 19, 1802, President Jefferson signed the bill creating the Academy.

At first the new school suffered much from the uncertainty of the period, the ideas of various political leaders and the lack of vision of its real purpose in the new nation. The War of 1812 found few trained graduates available for service, and hardly a definite policy for producing them. The disasters of that war spread large the lesson of military preparedness and awakened the government to the need of training. Captain Slyvanus Thayer, after a tour through the schools of Europe, was sent to reorganize and control the Academy. A hundred years of constant labor in training cadets has not removed the marks of the work of that great leader. The very backbone of academic training, the small section, the daily recitation, the frequent examination and the arrangement in order of merit was established by Sylvanus Thayer, now called The Father of the Military Academy. Whenever the corps forms in front of its barracks, it looks directly upon his statue, and many cadets are reminded of the great service of that early graduate.

In the Mexican War, General Scott found the graduates indispensable leaders, splendid tacticians and strategists. His memorable tribute to them is written in large letters at the entrance to Cullum Memorial Hall, where all cadet social activities are held. In the Civil War, the great leaders on both sides were generally graduates of West Point. Both General Grant and General Lee carried the West Point diploma. Their portraits are in the Cadets Mess Hall. The opening of the West, with its numerous and difficult Indian wars and Indian skirmishes, was shared largely by graduates of West Point. An Indian gallery in the Museum carries many trophies of the western campaigns sent in by graduates who took prominent parts in this work. The War with Spain and the Philippine wars have brought many names into the pages of Academy history. In the World War, the names of Pershing, Bullard, Liggett, Summerall and others are matters of every day knowledge throughout the country but West Point has a great and particular pride in them. An attempt was made during the World War to turn West Point into a training camp for producing a fine grade of drill sergeants to use for temporary officers. The classes in the Academy in 1918 were quickly trained in military work and short academic courses and were commissioned as officers. The course of study was changed from four to three years. Fortunately for the Academy, the course was changed to four years in 1920 and only a few cadets of the classes of 1922 and 1923 elected to take the three year course. By using officer instructors, the old customs and traditions have been fully restored and the full spirit of service is being carried into the Army with four full years of academic training. The service of the young officers graduated quickly in 1918 was excellent and added a fine record to the history of West Point.



Colors

The colors of the Country and of the Cadet Corps are carried in all ceremonies of the cadet organization. Here the color guard is receiving the colors before parade

Inspiration of Natural Beauty

There is the inspiration of the magnificent natural

scenery. The towering mountains are broken through on the north by the beautiful Hudson and show through the gap the wide plateau at Newburgh and the far-off blue Catskills. Across the river and behind the plain are wooded hills. To the south, the high mountains close in to hide the escape of the river. One remembers the old psalm: "I will lift up mine eyes to the hills, whence cometh my help." The architect has caught the spirit of his surroundings in the lofty Norman towers of the chapel and the Administration Building. The barracks and academic halls augment the call to arms of the towers.

Discipline

A cadet's life is monastic to a degree, isolated, uniform; controlled, directed and planned by superiors. His barracks are bare of creature comforts and the luxuries of college rooms. His presence is constantly demanded at roll calls at exact times, like the catching of a train. He rises each day at the discharge of a gun and retires at the blowing of a bugle. He constantly listens for calls to duty. He marches to meals, to drills and to recitations. In the mess hall his conduct is supervised. His recitations are given in a military manner in the section room to military officers. He is always in uniform, which must be correct, neat and clean. He must keep his room orderly and dustless, his bedding neatly folded and arranged and his arms shining and ready for service.

Four years of this between the ages of 17 and 25 instill habits of obedience, of orderliness and precision which are part of his conscience. Precision and uniformity may not make poets and painters but they do conserve time and energy, things which count toward victory in the day of trial by battle. Loyal obedience may curb individual expression but it also eliminates friction, unites divergent minds to a single purpose and advances the common cause promptly and fully. Discipline is a primary essential quality of military service which every cadet carries into the army with his commission.

The Plant and Equipment

In many ways, the nation has been generous in providing a great plant for handling, housing and teaching the cadets. A great power plant, over the West Shore Railroad tunnel supplies adequate heat, light and power for all academy work. Above this and along the ledge of rock below the plain stands perhaps the largest single riding hall in the world, comfortably lighted, heated and equipped for instruction in mounted service. Two large academic buildings and a splendid administration building complete the academic equipment. The barracks compose two large quadrangles, which when completed will adequately house the corps at its present strength. A complete gymnasium provides facilities for every type of indoor athletic training. Above them all stands a magnificent Gothic chapel. The officers and enlisted men are housed in comfortable buildings allowing their full energy to be devoted to the main task of instruction. A wide reservation of high wooded hills and valleys and the great Bear Mountain Park adjoining afford a wide variety of terrain on which to conduct military problems.

The excellent construction and fine architecture of the whole plant as it now exists gives an inspiring impression. It requires much construction to completely provide for its best work. An armory for winter work would greatly advance the military instruction. A laboratory for engineering training would improve greatly the final courses in the application of science to military design and construction. A modern hotel is almost essential to continue the cadet social life and to provide a stopping place for visitors and cadet relatives. A greater social hall is demanded by the large corps, and the barracks and mess hall are overcrowded. These shortages will eventually be understood and corrected by the Congress or by private endowment. A better plant will produce a better officer.

Conclusion

In the procurement branches of the Army, we talk a great deal about the comparative slowness of munitions mobilization compared to man power mobilization. But the training of man power is based upon adequate instructors of the greatest skill that can be imparted. We produced tactical leaders for small units in a few months at Plattsburg and other places by the intensive and strenuous repetition of fundamental things, just as in the machine shops in the stress of war production, we trained barbers and bartenders to thread the breech end of a howitzer, to bore the recuperator of a seventy-five or to grind a lense for a panoramic sight. These men were trained and supervised by journeymen. We cannot afford to dilute too thinly the skilled among the unskilled lest our training rate fall, our instruction become poorer and our product less efficient.

If we consult the lists of the Regular, National Guard and Reserve officers and note the ages of those in authority, we shall find a goodly number on the shady side of fifty years. And those of us in the rushing exuberant forties, who are struggling with the war plans, who look with eagerness at the higher offices and who now and then indulge our minds in a little bold criticism of things as they are, can count only twenty odd summers in which to carry out those great thoughts of ours for rebuilding the National Defense. As we enter the age of obsolescence, we must look back to see that the age of adolescence is cared for and that with the proper spirit of service, the newer generations are stepping into the places we vacate.

It is desired to make clear that a great apprentice school exists at West Point for adequately teaching the future national defenders; also that those who come from its doors are journeymen mechanics in the trade of war, capable of being assigned to any of its tasks with a good chance of handling that task well; that they are the best material obtainable from which to train the master workmen for the great task of war; and that the spirit, gathered in the atmosphere of West Point, the high ideals of service, and the true sense of honor which is imparted will go far in influencing those who are taken from other walks of life to lead the soldiers of America. West Point is not to be judged on a basis of monetary expenditure without considering monetary results in the broadest way. It is not to be judged solely by its academic, or military, or athletic work, but by those broad fine attributes of leadership and character which it gives to its students to carry into their life work and to spread among all officers of the Army.

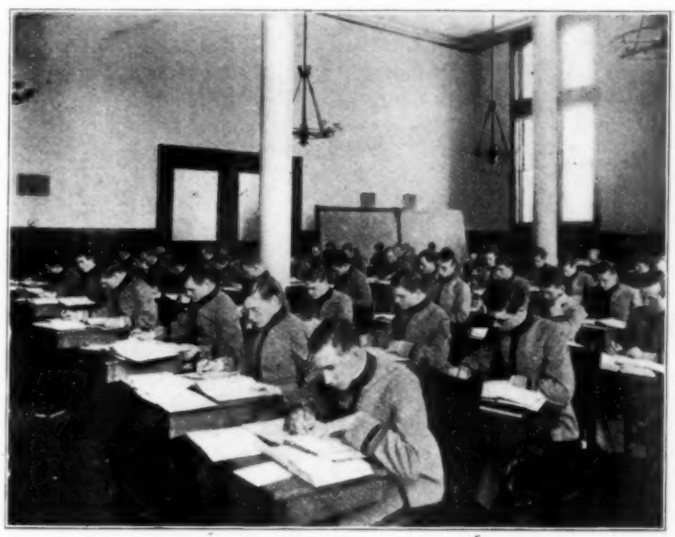
It may be true that Mark Hopkins at one end of a log and a student at the other constituted a complete college but a school for the country's service to train men for the great crises on the field of battle is something more than that; it is a school of tradition, of patriotism and of lofty inspiration, depending upon a long and praiseworthy past, an idmirable location, a splendid plant, and a forward-looking spirit of service.

Academic Work at the Military Academy

By

H. G. STANTON

THE United States Military Academy is essentially an educational institution intended to teach young men those fundamental principles which will make them valuable not only as Army officers but also as citizens. One of the most important objects of the Military Academy is to subject the cadets, prior to their promotion to a higher grade in the Army, to a thorough course of mental as well as military discipline, to teach them to reason accurately and readily to apply right principles to cases of daily occurrence in the life of a soldier. A strict course of mathematical and philosophical study, with application to the various branches of military science, is by far the best calculated to bring this end, and the present course at the Academy, the result of the experience of many years, is in its main features such a course. It is realized that many of those who pursue a scientific course at any institution, will have little occasion to make practical applications of the many mathematical formulae they meet, and that they may have passed over certain problems without thoroughly understanding their meaning in all their points. Still, if the course has been carefully taught, the reasoning faculties will have been strongly exercised and disciplined and a system and habit of thought acquired which are invaluable in the pursuit of any profession.



Cadets at Written Examination

The honor system at West Point is a matter of personal responsibility and careful training. It extends not only to examinations but to all recitations and personal conduct in the Corps

For purposes of academic instruction at the Military Academy, the classes are divided into sections, at present numbering about 18 cadets per section. This division into sections was instituted in 1818 and since then the number of cadets in a section has been substantially the same. The manner of conducting a recitation; testing the cadet's knowledge of the subject recited upon, and imparting instructions, have followed the same lines since 1820. In recent years, however, much more instruction has been given, more assistance rendered cadets, and much greater stress laid upon the practical applications of the theories taught.

The daily tasks are made of the requisite length to demand all the study time allowed, and thus the invaluable mental effort and discipline derived from hard study are secured. The daily tasks made progressive, based upon accepted fundamental principles, continually exercise the reason, instill a growing confidence, and establish in a cadet a belief in his ability to master every new difficulty. When the course is completed, the student should find himself equipped with a satisfactory knowledge of the essential principles of the general branches of science, to which he may add by individual study without feeling the necessity of reconstructing his foundation. This is believed to be the true governing principle of all sound education.

The academic course has for a century been based on three fundamentals:

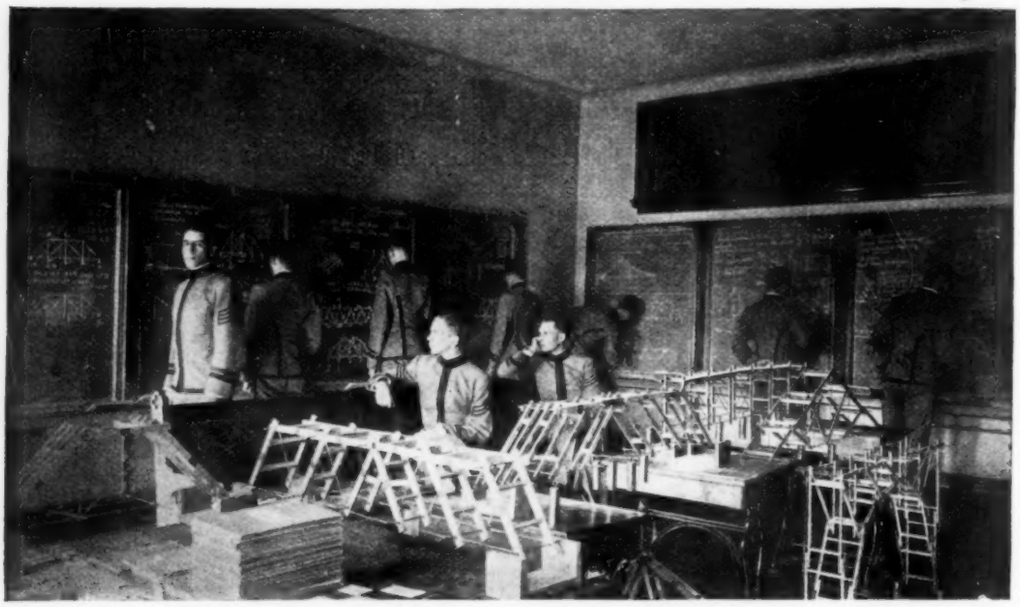
1. Every cadet in every subject;
2. Every cadet proficient in every subject;
3. Every cadet every day.

In other words, every cadet must take the whole course—there are no optional or exceptional studies; every cadet must attain the standard in everything—deficiency in one subject is deficiency in the course; each cadet must be prepared to recite every day upon all the subjects of study upon which he is engaged at that time. While all these are adhered to in principle and in practice, there is a slight qualification in each sufficient to give some flexibility of application. In the first, although all go through the same course of study, the highest men in the class go a little further in some subjects. In the second, although proficiency in all subjects is demanded, a cadet standing well in other studies may, if deficient in one, be allowed to continue and make up a deficiency by the next examination or be turned back to join the next class, if, in the judgment of the Academic Board, the conditions warrant this leniency. In the third, although every cadet is likely to be called upon to recite at every attendance, occasionally he is passed over owing to lack of time. But the escape is so rare that it can never be counted upon, and the necessity for unremitting preparation is as great as though there were no exceptions.

In order that the principle of *every man every day* may be carried out, the classes are divided into small sections of approximately 18 cadets, each section having a separate instructor. The student rises or falls in his

class by transfer from one section to another, according to his weekly marks. These marks for all recitations are posted every week and each man has accurate knowledge of his status at all times. Study is in quarters during specified hours, and is varied with gymnastic and military duties.

The corner stone of the course is mathematics, and the bulk of the structure is made up of the exact sciences. The course, similar to those in our colleges, consists of two parts, the Arts and the Sciences. The Arts course comprises English, French, Spanish, History, Law, Economics and Government. The Science course comprises Mathematics, Engineering, Ordnance and Gunnery, Natural and Experimental Philosophy, Chemistry, Electricity and Drawing.



Recitation in Engineering
Civil and mechanical engineering comprise the major work of graduates since the founding of the Academy

The recitations are not merely occasional or scattered questions, but a demonstration of principle at the board or the solution of problems, and are also frequently converted into partial or general review written examinations either of principles or problems. For the determination of proficiency there are, in addition, the regular semi-annual and annual examinations which are wholly written. At all the examinations the burden of proof is upon the cadet. The general standard of proficiency is 2.0 on a basis of 3.0 for a perfect recitation. Should his mark for the term in any subject fall below that percentage of the maximum in that subject he is, *ipso facto*, deficient and must justify himself in the semi-annual or annual examination or be discharged. Any form of deception at recitations, besides being practically impossible, is frowned upon by the ethics of the Corps. The cadet stands absolutely upon his merits in all his academic work.

The present scale of marking has been adhered to since 1817. Upon this scale a perfect recitation receives a mark of 3.0; good is represented by 2.5; fair by 2.0; bad 1.5; very imperfect 1.0, and complete failure 0.0. Gradations between these marks may be made if it is warranted by a cadet's recitation. These daily marks are made upon the cadet's daily section room work and upon certain practical work during his entire career at the Academy. The summations of the daily marks obtained by a cadet during the study of a particular subject, in general, represent his relative proficiency in the subject.

A semi-annual examination is held during the last week of December, and the annual examination is held at the close of the academic year in June. Recitations are thereafter suspended until September 1st. The Academic Board may dispense with the examination in any subject of all cadets who have shown satisfactory progress in the subject. Usually cadets are excused from examination if they have an average mark on such review as follows:

1st Class	2.2
2nd Class	2.1
3rd Class	2.0
4th Class	2.0

No cadet is pronounced deficient in any branch of study, except drawing or a course involving practical work only, unless he has been subjected to a written examination upon the course pursued in that branch, and unless the average of advance, written general review and examination grades is below 2.00, the examination being weighted one-fourth of the total.

Each subject of study has attached to it an assigned weight, which is fixed by the Academic Board. The weights give the relative values attached by the Board to the different subjects as part of the military curriculum.

The weights assigned to the several branches of study and to conduct for the general merit roll are as follows:

Fourth Class

Subject	Weights
Mathematics	175
English	90
French	90
Surveying	50
Military Rating	25
Conduct	25
	455

Third Class

Mathematics	275
English	100
French	100
History	100
Drawing	100
Military Rating	25
Conduct	25
	725

Second Class

Philosophy	300
Chemistry	250
Spanish	100
Drawing	50
Military Hygiene	30

Subject	Weights
Military Rating	50
Conduct	50
	830

First Class

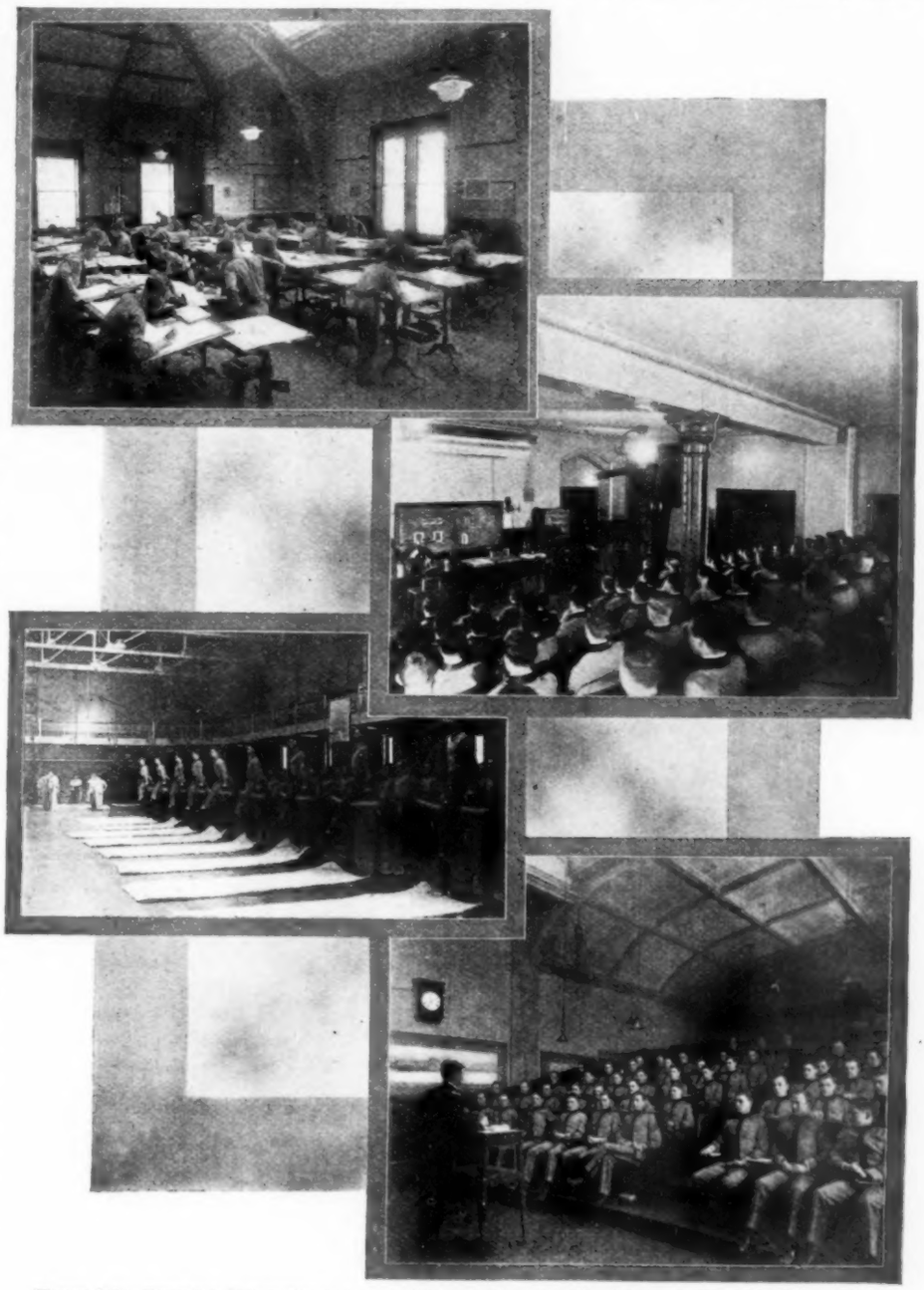
Engineering	250
Ordnance and Gunnery	150
Law	150
Military Art	60
Economics and Government	150
Military Rating	75
Conduct	75
	910

In each branch of study each member of the class receives the same proportional part of the weight given above that his final total in that subject bears to the maximum possible final total. At the annual examination, all cadets whose total proportional parts on the general merit roll are 92.0 per cent of the possible total are classed as "distinguished."

After the annual examination of the first class, the Academic Board forms a roll of the class arranged according to their graduating standing as determined by the aggregate proportional parts of the weights assigned to the graduating merit roll. Every cadet of the first class who has been found proficient in conduct and in all the studies and exercises of the prescribed academic course receives a diploma signed by the members of the Academic Board. The names of the graduates, whose characters as shown by their conduct as cadets are deemed satisfactory, are presented to the War Department in order of graduation with the recommendation of the Academic Board for commission in the Army. Opposite each name is given the order of preference of the various arms to which the graduate desires to be assigned. No cadet is recommended for commission until he has completed the entire course of studies at the Academy. Upon the commission of the members of the first class to the grade of second lieutenant their relative rank corresponds with their standing on the graduating merit roll established by the Academic Board.

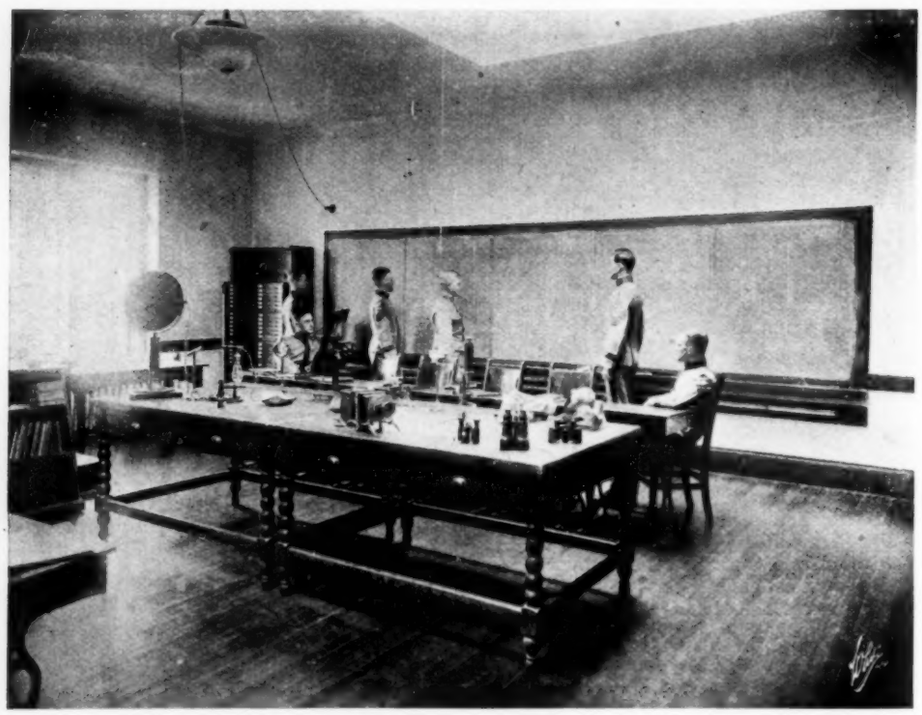
The Academic Departments, in the order in which they were created by law, are: Tactics, Civil and Military Engineering, Natural and Experimental Philosophy, Mathematics, Chemistry, Mineralogy and Geology, Drawing, Modern Languages, Law, Ordnance and Gunnery, Military Hygiene, English and History, Economics and Government and Political History.

The academic course as it now stands is very exacting and so extended that it demands the utmost energies of the cadets. The strain is very severe and unrelenting and it is thought that nowhere, except at the National schools, is so much exacted of every individual from first to last. A thorough preparation is necessary for a



Upper left: Drawing Instruction; center right: Lecture in Chemistry; center left: Gymnastic Exercises; lower right: Lecture in Law

satisfactory completion of the course, and the lack of this preparation is the principal reason for the large number of deficient cadets, who are discharged every year after the semi-annual and annual examinations. The Academic deficiencies, in recent years, have been so large that the Superintendent stated, in his Annual Report for 1923, "During the past few years, the casualties in the Fourth Class from academic deficiencies have been heavy. Analysis of the situation indicates two chief causes for this condition: 1st, the submission by schools of certificates which do not accurately represent a student's ability and attainments; and 2nd, a lowering in the character of the teaching in the preparatory schools.



Recitation in Natural and Experimental Philosophy

Under the certificate system, the Academic Board regularly accepts certificates showing the necessary number of units, the required subjects, and good grades. It should be a fact that such certificates, based on daily contact with a student through four years of preparatory work, constitute by far the best evidence of his ability to master successfully the course at West Point. The Military Academy should be able to regard students with satisfactory certificates as "good risks."

Unfortunately, the results during the past few years have been disappointing. A study of the statistics over a four-year period shows that of those admitted by certificate, 29.64 per cent were discharged for academic deficiency. After the semi-annual examinations of 1922, for example, in the single subject of Fourth Class English, forty-nine cadets were deficient, every one of whom had been admitted upon certificate showing grades well above satisfactory in that subject. The English deficiencies which caused the discharge of these cadets were basic and elementary, deficiencies in the first principles of grammar, deficiencies in spelling, deficiencies in any sense of composition form.

There is noted, however, what seems to be a general lowering of the standards of preparation. It may be that during these recent years the Military Academy has been receiving for the first time the product of schools whose teaching staffs had been reduced as a result of the war conditions. Whatever the cause, the character of preparation has been poorer than in former years. Out of nine hundred and sixty-eight cadets admitted during a four-year period by certificate, two hundred and eighty-seven, or 29.64 per cent were discharged for academic deficiency; and out of four hundred and twenty admitted by examination, sixty-four, or 15.23 per cent were discharged. Such a heavy casualty list indicates an inadequate grounding.

It is interesting in this connection to note that our results show how widely the standards differ in the several sections of the country. Where there are notably good school systems, the students coming therefrom succeed readily in mastering the West Point course. Where the school systems are poor, the students have the utmost difficulty in the Academy. The analysis of the figures by States shows that Massachusetts ranks best, with only 8.7 per cent. of cadets admitted therefrom failing in their studies. Florida is second, with 11.1 per cent. failing; New York is third, with 12.3 per cent. failing; and North Dakota, South Dakota, Illinois, North Carolina, Vermont, New Jersey, Kansas, California, and Michigan follow in the order named, all having less than 18 per cent of failures. At the other end of the list we have the deplorable record of one State which showed as high as 52.6 per cent of failures of its entrants to master the course.

The unfortunate results of these conditions need no emphasis; they are evident enough. The Government is led by the certificates to believe that a young man has been satisfactorily grounded in those subjects required for admission, accepts him as a cadet, and labors and spends money upon him only to find after a few months or a year that he has not had the quality or quantity of preparation necessary to enable him to master the course. Moreover, the young man who has received these grades has been misled. Having no standards of comparison himself, he is led to believe that his educational progress has been fully satisfactory and that he is qualified to go ahead with a severe course in an institution of higher learning. The awakening to the true condition is hard and disheartening. The student's hopes and aspirations, legitimately based upon his school record, are blasted, and the shock of disappointment may well affect him for years afterward."

In our service today, there is no other place than the Military Academy, provided for in our system of military education, for fundamental training in the arts and sciences, and in this respect, the Military Academy is unique in its position as our only existing military university which is antecedent and preparatory to the special professional schools.

New York Engineering Societies Endorse Industrial Preparedness Plans

New York Post *of* Army Ordnance Association Explains Need for Cooperation

"PEACE Insurance" was the key-note of a gala meeting of the Ordnance and affiliated engineering societies of New York City at an "Industrial Preparedness Dinner" held at the Hotel Commodore on February 5th. Leaders of industry and finance, captains of commerce, engineers and executives of the most representative engineering societies of the nation were there. The Government was represented by several of her high officials. The meeting was without doubt one of the greatest testimonials for adequate industrial preparedness that has ever been held in America in peace times.

Judge Gary

The dinner was given by the New York Post of the Army Ordnance Association and the New York Sections of The American Society of Civil Engineers, The American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, The American Institute of Electrical Engineers and the Society of Automotive Engineers. Nearly one thousand were present.

Judge Elbert H. Gary, Chairman of the United States Steel Corporation, who is also President of the American Iron and Steel Institute and a member of the Army Ordnance Association, presided. The Honorable Dwight F. Davis, Assistant Secretary of War, was present and addressed the gathering on the meaning and importance of Industrial Preparedness. Major General C. C. Williams, Chief of Ordnance, and General John J. Carty, Vice-President of the American Telephone and Telegraph Company, also spoke. Colonel James L. Walsh, of the Bankers Trust Company, who is also chief of the New York Ordnance District, brought on the *denouement* of the evening with his plea for industrial cooperation with the War Department in carrying out its preparedness plans.

All in all, the meeting was a great accomplishment. Not since the stirring days of almost a decade ago when "preparedness parades," etc., were the vogue, has such enthusiasm and interest been displayed. What the meeting means for the welfare of our country cannot be fully measured now, nor can the meeting itself be adequately described in such an account as this.

Committees in Charge

Great credit is due the Committee on Arrangements for the success of the affair. The Committee was composed of Colonel T. L. Ames, A.O.A.; Harold M. Lewis, A.S.C.E.; M. H. Merris, A.I.M.E.; Captain C. E. Davies, A.S.M.E.; Major H. S. Sheppard, A.I.E.E.; Henry G. McComb, S.A.E.; and Captain H. W. Churchill, U. S. Army.

The following committees represented the several affiliated associations:

Army Ordnance Association—General Samuel McRoberts, W. W. Coleman, Colonel Charles Elliott Warren, Colonel Ralph Crews, and General Guy E. Tripp, President of the New York Post, A. O. A.

American Society of Civil Engineers—General William Barclay Parsons, J. Vipond Davies, J. Waldo Smith, John P. Hogan, and J. H. Edwards, Chairman of the New York Section, A.S.C.E.

American Institute of Mining and Metallurgical Engineers—A. S. Dwight, W. L. Saunders, B. B. Thayer, Pope Yeatman, and Bradley Stoughton, Chairman of the New York Section, A.I.M.M.E.

American Society of Mechanical Engineers—General George W. Goethals, Thomas E. Murray, H. Hobart Porter, Henry R. Towne, and John Lawrence, Chairman of the New York Section, A.S.M.E.

American Institute of Electrical Engineers—E. W. Rice, Jr., Colonel Frank B. Jewett, Gano Dunn, John W. Lieb, and L. F. Morehouse, Chairman of the New York Section, A.I.E.E.

Society of Automotive Engineers—Alfred F. Masury, Azel Ames, Harold L. Pope, Henry G. McComb and Cornelius T. Myers, Chairman of the New York Section, S.A.E.

Judge Gary's Remarks

The dinner served, Judge Gary asked that the diners rise and stand as a tribute to Woodrow Wilson, the bugler blew "Taps" and "The Star-Spangled Banner" was played. The Chairman then asked that a toast—"of cold, pure water"—be drunk to the President of the United States, whose telegram of congratulations was then read. We have reproduced the President's message on the Editorial Page of this issue of ARMY ORDNANCE.

The following messages were also received and read by Judge Gary: a radiogram from Egypt from General Guy E. Tripp, President of the Westinghouse Electric and Manufacturing Company and President of the New York Post of the Army Ordnance Association: "Impossible to reach New York Post dinner. Especially regret because occasion with Judge Gary presiding will arouse interest in preparedness plans which journey around the world convinces me are essential."

From Colonel Bruce Cornwall, Chief of the San Francisco Ordnance District the following wire was read: "The California Post of the Army Ordnance Association is happy to extend to the New York Post and the New York Sections of the other engineering societies its congratulations and best wishes for the success of your

get-together dinner. The united effort that New York is thus making will be a guide and inspiration to the cause throughout the country."

Judge Gary then said, in part: "This is a large audience, composed of sensible, serious, loyal men. You come here tonight, not for the mere enjoyment of association, not for the ordinary purposes of a festivity or banquet, but in response to the call of duty. That which prompts you to come and give attention to the words that shall be spoken is precisely the same that would control your movements if you were embarking in a war of defense of your country.

Colonel Davis

"The people of the United States love peace and abhor war. They seek no quarrels; they desire no territory or extension of power beyond the confines of their own country. They will submit to many things that may appear to be unreasonable and sometimes to those which are unconscionable. But that kind and character of man, if aroused to duty in defense of his country, is the most to be feared because he is the most terrible in a war which is forced upon him. However, notwithstanding he desires peace, he is slow to decide that war is forced upon him, but whatever may be his walk in life, he will rush to the defense of his country when called upon to do so. Witness the action of the people of the United States during the last great war! Many of you know by personal contact and experience what throngs of men from the different walks of life went to Washington and, though not called upon to shoulder a gun or to actively participate in fighting, yet devoted time and attention, patiently, intelligently, to the service which each one was best fitted to render. Notwithstanding it was believed by military men of different countries that the United States was unprepared for war—as it was—it was found by experience that the energy, the activity, the rapidity of movement of the men of America in all the different phases of activity enabled them to get ready in a short time, and then when the soldiers who took the lead in fighting were called into action, they demonstrated to the world that there were never better soldiers in any war or in any country. (Applause.)

"The Army Ordnance Association is doing what it can to give evidence of the part it proposes to take in securing the safety of the people and the protection of civilization. If you will pardon me for a moment, I will read to you a copy of the resolution that was passed at the last meeting of the Board of Directors of the American Iron and Steel Institute:

"'*Resolved,* By the Board of Directors of the American Iron and Steel Institute, that to the extent the United States Government may need the assistance of the Iron and Steel Industry in the maintenance of conditions adequate for the military defense of this country, we pledge the active efforts of the members of this Board, and we express the belief that the entire Iron and Steel Industry will approve the sentiment expressed and will cooperate in carrying it into practical effect.' (Applause.)

"With exactly that disposition, you gentlemen are here tonight. You business men, carrying great responsibility, educated, trained in your professional lines, with plenty to do in your various places, are willing to devote your time, your skill and your services to the cause of preparation, and you believe that it is just as necessary for you now and henceforth to take part in the movements which are calculated to preserve peace, or to insure peace, as it has been expressed, as you were during the war; and the largest and the best compensation you will receive by what you propose to do and what you will do, is found in your own hearts." (Applause.)

The Assistant Secretary's Address

Colonel Davis, the next speaker, said, in part: "Sometimes I feel, as the result of the duties that have been put upon me by Congress, that I am in Washington largely as a representative of the business men of the nation, to represent them in planning to utilize their resources in the nation's defense, and I am always glad of an opportunity to report back to my constituents, to tell them what we are trying to do in planning for the greatest, most difficult, most complex business problem that can ever confront a nation—the mobilization of its industrial resources in the event of war!

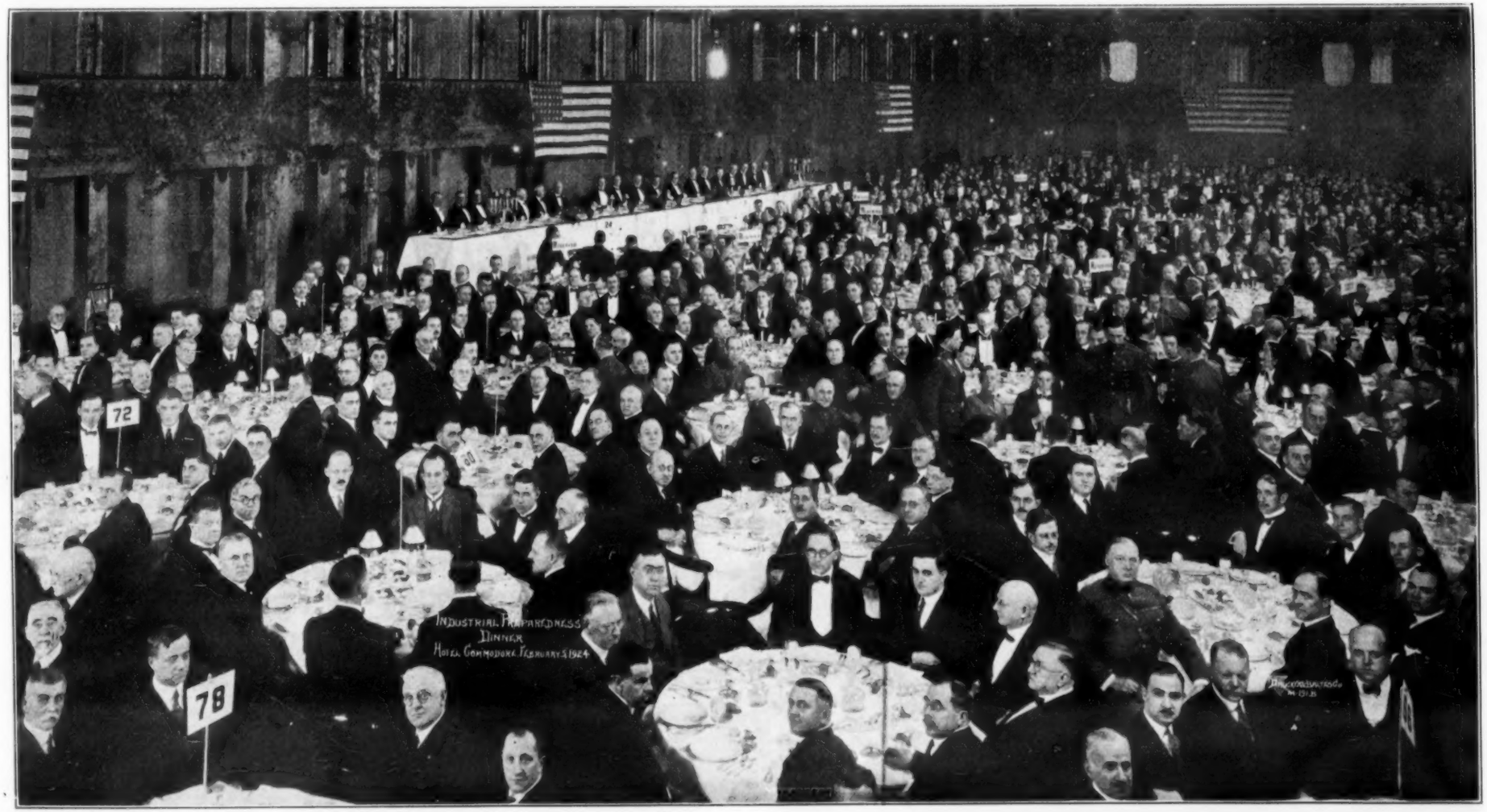
"Before making my report, however, I want to felicitate the Committee that arranged this dinner, for the subject which they have chosen for discussion tonight, because it seems to me that it sums up the whole purpose of this industrial planning: industrial mobilization as an insurance against war.

"The heroic farmer of the Revolutionary days, armed with muzzle-loading rifle, could not stand up today against machine-gun bullets, gas shells and aeroplane bombs. The British and the French soldiers, in the early days of the war, although they were brave and able soldiers, were forced back on Paris, foot by foot, largely through the superior weight of the German artillery. We read of Russian soldiers thrown into battle without arms and ammunition, and of the resultant slaughter. So we have come to realize that munition power is just as important as manpower in National Preparedness!

"In this connection, the problems confronting a nation at the outbreak of a war are very similar to those which a business man would meet in developing a new manufacturing industry. He would need a trained organization; he would need a plant and materials. An organization without plant and materials would be of little use to Judge Gary in producing steel; of no more use than the plant and the materials without the organization. So a manufacturer must have manpower, his trained organization, and munitions power in his plant, and his materials. In the same way, a nation, about to go into war, must have its trained forces ready for action; must have its equipment with which to supply them, and particularly it must have a carefully worked out plan by which all of the industrial forces of the nation can be brought into action.

"*This is not in any sense militarism. It is just common business sense!*

"In working out the plans for industrial mobilization, we have tried to adopt the methods which a business man would adopt in planning for his own business. Our first problem was to find out what our needs are. In order to do this, we have studied the mobilization curve of the General Staff, which shows how many men will be called into service month by month; the articles of equipment which they will need, and the various other supplies which must be given to them before they can fight. This sounds like a very simple proposition, but when you realize that an army needs some 700,000 differ-



Industrial Preparedness As Insurance Against War

Dinner given by the New York Sections of the Army Ordnance Association, American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, and Society of Automotive Engineers, in Cooperation with the War Department, at the Hotel Commodore, New York City, February 5, 1924

ent items, in varying quantities, at varying times and of various kinds, you will agree that it is not as simple as it sounds. As a matter of fact, it took fifty officers about a year just to figure out the requirements.

"For example, we figured the other day on the cost of leather items which would be needed by an army the size of our army during the last war. We figured the cost as compared with the cost for those same items during the last war. We found that, due to these plans, due to the fact that we knew what our real requirements would be, there would be a saving of $200,000,000 in the item of leather goods alone.

General Williams

"Having figured these requirements out, the next thing to do was to find out where we could obtain them. In order to do that, we are making a survey of the industrial resources of the entire country. In order to decentralize the work, we have established 14 procurement districts into which the country is divided, and in many of these districts we have drafted enthusiastic, patriotic business men as District Chiefs. For example, Colonel Walsh is the District Chief of the New York District. When these districts are established, we allocate to them the supplies which the district would be required to furnish in time of war, and allot to them the different plants in their neighborhood. The plants are visited by their field representatives; problems of production are studied, and later, when all of these details are coordinated, tentative contracts may be let to the various plants, so that they will know what they will be required to furnish in time of war.

"We have been working recently on a standardized form of contract, in order that we may eliminate many of the misunderstandings and the difficulties which arose during the last war.

"To put it before you briefly, when the plan is finally completed—if, indeed, it ever can be—upon the outbreak of an emergency, telegrams would radiate from my office to the fourteen procurement districts; from them to the 10,000 plants all over the country, which would be required to do war work. Each manufacturer could go to his safe; take out his production schedule, plans and specifications for the articles that he was to produce; take his standardized form of contract, sign on the dotted line, and the next day begin work. (Applause.)

"In working out all these problems we have been very fortunate in having the cooperation of the leaders of industry all over the country. Take, for example, in our own profession, committees from the American Institute of Mining and Metallurgical Engineers, through the splendid and farsighted public spirit of Colonel Dwight, have been studying these problems of various raw materials, and when they have finished their reports, no doubt they will be of great value to industry in peacetime, and of course will be absolutely invaluable to us in time of war. The American Railway Association is cooperating by studying the transportation problem. The American Telephone and Telegraph Company, through the enthusiasm of Mr. Thayer, its President, has agreed to take over the communications problem. The Iron and Steel Institute, as you have heard from Judge Gary, has offered all of its vast resources in studying the problems of steel. And so it goes with every profession, every branch of science throughout the country.

"Mr. Baruch, the able Chairman of the War Industries Board in the last war, has given us very valuable advice as the result of his experience, both on the problems that we are likely to meet, and particularly on the question of super-boards which it may be necessary to establish in case of another great emergency.

"Every association—national, chemical, engineering, electrical—associations of all sorts are cooperating in their fields. They realize that these plans are their plans, just as much as they are our plans. They are the plans of industry to do its part in the National Defense!

"In all this work we have kept in mind but one end—the NATIONAL SECURITY! We have had no ideas of any aggressive purposes. We only seek to make this country safe! America stands ready today—and I speak advisedly—to limit, by international agreement, armies, armaments and war preparations of all sorts to the minimum consistent with National Defense. (Applause.) We have already shown our good faith in this matter. We have reduced our Army, and particularly, our Air Force, below the safety point. We took the leadership in the reduction of Naval armaments in the great Washington Conference.

"We have today the smallest regular Army of any great power in the world—whether you consider it from the standpoint of ratio to population, to national expenditures, to national wealth, or to national resources.

"We are ready to do our part; we earnestly desire lasting peace among the nations, and our defense plans are based, fundamentally and solely, upon that mutuality of responsibility which is the very foundation of our democratic institutions." (Applause.)

Address of General Carty

General John J. Carty, the next speaker, said: "Mr. Chairman and Gentlemen: The splendid message which we received tonight from President Coolidge is a reminder to me of a message which I received from President Wilson during 1916. At that time, I was President of the American Institute of Electrical Engineers.

"The President of the United States wrote a letter to me calling upon the Institute to aid in preparation for the national defense. At once I repeated this call to all of our membership.

"How promptly, how patriotically, how nobly American engineers of all the societies answered the call of their Chief Magistrate, is now a matter of history. So great was our unpreparedness, that had we delayed a year or even months, our country might have suffered a humiliating and disastrous defeat. American institutions would have been endangered; even civilization itself might have been placed in jeopardy.

"At times, it seems as though these great lessons of the war have been lost upon us. But this distinguished meeting tonight is but one of the many evidences that such is not the case. We are not gathered here to discuss a matter of politics, or to aid our government in carrying out a national policy which is the product of any one political party. We are gathered here as American citizens of all shades of political opinion, to aid our government in the carrying out of a policy of national defense which was established by a congress in which all political parties agreed in the passing of a wise statute which places upon the Assistant Secretary of War the great responsibility of mobilizing the industries of our country for the purpose of national defense. This duty is placed by law upon the office of the Assistant Secretary, whoever he may be, regardless of the political party

to which he may belong, or of any personal political views which he might hold.

"We are not gathered here to advocate war, for we detest war. The industries of America desire nothing so much as they desire peace. But they have learned that if our country is kept at all times prepared to resist unjust aggression, then we have a most powerful insurance against attack—a most potent preparation for peace.

"From the earliest times, the work of the engineer has been to lighten the labors of man and to provide him with agencies for the advancement of the arts of peace. That these peaceful agencies are convertible into deadly engines of war is one of the great lessons of the late conflict. Few, indeed, are the products of American industries which, in a major emergency, would not be classed as munitions of war. We are here concerned, therefore, not with that relatively small number of industries devoted to the manufacture of guns and ammunition; but the problem which we are discussing tonight affects directly nearly every factory in the land. It would be hard to imagine more peaceful agencies than the telephone and the telegraph, or more beneficent discoveries than prophylactic medicine and antiseptic surgery. But it is now recognized that without these, the great war could not have been fought. Peace is not to be obtained by prohibiting the development of agencies because they can be employed for the purposes of war. We must be prepared, so that these and perhaps even greater agencies yet to be discovered shall not be employed against us, to our own destruction.

"How can the industries of the United States best prepare themselves to aid in the defense of our country in the event of a great national emergency? In my opinion, the best answer is this: Each industry should study in advance how to meet the emergency requirements which may be laid upon it by the Army, the Navy, and the civilian population, upon whose activities in the last analysis all our naval and military operations are based. As the late war demonstrated, these requirements would tax to the utmost our productive capacity. These requirements also compete with each other, and the problem of their adjustment is a most difficult one.

"A study has already been undertaken by the telephone industry, at the request of our government, as has just been stated by Secretary Dwight F. Davis. By direction of Mr. H. B. Thayer, the President of my company, I am now at work upon the subject with the authorities at Washington, and the Western Electric Company which is the manufacturing branch of the Bell System is cooperating actively with a view to determine as definitely as possible in advance the probable emergency demands of the Army and the Navy. These will be coordinated with the probable civil demands, so as to minimize as far as possible the disastrous effects of a war upon this vital industry.

"Although we are a great nation covering a continent, we do not produce all that our own industries require. It took the experience of the late war to demonstrate for the first time to the industries themselves how dependent they were upon apparently minor products, without which their principal activities would cease. A study of these products has been made in the Secretary's office which shows that if certain foreign sources of supply were cut off, many American industries would be sadly dislocated, unless a substitute could be found. A study of this matter of special, though apparently insignificant, items entering vitally into our manufactures will be of the greatest importance to our industries, even in time of peace, for it calls attention to the necessity of having alternative substances or substitutes.

In my own industry, a study of this kind, in order to render our government independent of foreign nations for certain items of material, gives great promise not only of the development of substitutes, but of the attainment of economies of great value to our business. I think that a study of this matter of alternatives or substitutes by all of the other industries would be sure to result in a great many economies and improvements in their peace-time activities. In many cases I am certain that these improvements would be so great that they would of themselves repay the industries for all of the time and money and effort which they might put into this vital matter of industrial preparedness.

Colonel Walsh

"In conclusion, I wish to say that after a careful consideration of the problem now before us, I am satisfied that if we cooperate heartily with the national government, we will thereby gain a large measure of insurance against such grave dislocation of industrial operations as was caused by our unpreparedness during the late war. The deplorable financial and economic results which followed from this unpreparedness are still seriously felt in most of our industries.

"We may not hope by any degree of preparedness, however wisely we may plan, wholly to avoid the serious losses which would fall upon all of the industries in the event that our country were again plunged into a great war. But we may hope, and we may confidently assert, that if American industries are adequately prepared to support our government in upholding the integrity of American institutions, we have done one of the things needful to preserving the peace of the world." (Applause.)

General Williams Speaks for Ordnance Department

General C. C. Williams, the esteemed Chief of Ordnance, said: "I am not going to try to recount to you any of the trials and tribulations of the Chief of Ordnance. I can assure you, however, that they exist, and that they are with him all the time.

"At the end of the World War we realized that perhaps one of the greatest services that we could do for those who came after us was to endeavor to put our experiences into some kind of durable form. We, therefore, commenced our work on Industrial Preparedness, and it has been most gratifying to see the support that we have had in all parts of the country, and especially the support displayed tonight when Judge Gary has been so good as to be with us, and all of the other distinguished gentlemen who are here to lend us their support. I can assure you that our hearts are filled with gratitude.

"The New York Ordnance District is, of course, one of the most important that we have. General Delafield was in charge of it, but he was called to other duties, and then Colonel Walsh was put in charge. It is very gratifying to me to see that he is getting such loyal support in his work, as is evidenced here tonight, and I wish to extend to you the most sincere thanks of the Ordnance Department for your interest in this great work." (Applause.)

Colonel Walsh Urges Cooperation

Colonel James L. Walsh, Chief of the New York Ord-

nance District, said, in part: "I am very glad to be afforded this opportunity to tell you something of the problems the New York District is facing in making plans for the production of ordnance in event of war. To be able to talk to you all at once—instead of individually—makes for economy of time; and in all matters pertaining to war, time is of the essence. In 1917, Congress could and did appropriate billions of dollars, but they did not and could not appropriate a single second of time. That is what we are now trying to do—to appropriate time.

"The mere magnitude of the ordnance problem would alone make it difficult enough. But there are other factors which render it still more difficult. The first of these complications is the fact that ordnance consists solely of implements of war, the things the soldier fights with—and since we are a peace-loving nation, there is no large industry already built up for the prompt manufacture of ordnance in an emergency. The nation knows perfectly well how to house men, to feed men, to clothe men, to transport them by water, rail, motor or horse, surround them with the best of medical, surgical and dental care, provide them with the most complete and instantaneous methods of communication, but it does not as a result of its peace-time activity, know how to arm its manhood. Recently I looked over the list of articles of ordnance manufactured in this district during the war, and, of the entire $400,000,000 worth actually paid for, I doubt if you could today—in open market—purchase a nickel's worth. All other preparations—of matériel or personnel, of organization or training—can be made more quickly than the manufacture of ordnance, which, therefore, sets the pace at which the country can make ready to defend its sovereignty.

"Another factor which complicates the solution of the ordnance problem is that weapons for war change rapidly. If we put soldiers in the field ten or fifteen years from now, it is entirely probable that they will eat the same old beans, wear the same kind of boots, and sleep under the same grade of blankets, as they did in the World War, but since then there has been a great increase in the variety and power of weapons, so that it is impossible to predict today just how our forces will be armed in the next war, if there should be one.

"Our own Ordnance Department has designed a 75-mm. gun with twice the range of the French *soixante-quinze* used in 1918. The redesigned 155-mm. gun outranges the French G.P.F. by nearly five miles, the new 4.7-inch gun outranges our own pre-war design two and a half times and fires a heavier projectile at that. Even after the armistice, when a Board of Line Officers got together to formulate their specifications for an ideal caterpillar tractor for divisional artillery, the highest speed pictured in their most optimistic dreams was 12 miles an hour; in the meantime, the Holt Manufacturing Company has already produced an ordnance tractor that can attain a speed of 30 miles an hour and can negotiate a 45-degree slope without difficulty. Incidentally, it can be driven submerged in water up to the driver's chin. The largest aerial bomb effectively used during the war weighed only 400 pounds, whereas within the year the Ordnance Department has successfully designed, manufactured and dropped from an aeroplane, a bomb ten times as large. Newly perfected automatic shoulder rifles bid fair to replace the Springfield magazine rifle of World War days; the .50 caliber super-machine gun recently developed, shoots a bullet weighing four times as much as the .30 caliber Browning and throws it nearly three times as far.

"So you see the Ordnance problem can never be completely solved, everything is in a state of flux, and we must accustom ourselves to that condition. If the World War can be taken as a criterion, we may expect repeated insistent demands for whatever weapons the fighting forces believe will help them to fight more effectively. In this respect, we of the Ordnance envy some of the other staff departments. If an Army Commissary suddenly got a requisition for *pate-de-foie gras* or hot-house grapes or some other rarity as a substitute for the beef and bread of the old army ration, or if the Quartermaster were told that our troops could fight better clothed in chinchilla or ermine instead of "olive drab," he would be vastly surprised, but, in war time, requisitions just as difficult to fill are coming in on the Ordnance Department all the time and we have got to fill them—exactly and completely—and do it cheerfully.

"The natural question arises—if styles change so rapidly in ordnance, why plan now for the production of weapons that may soon be obsolete? The answer to that is—all of our armament has been carefully reviewed in the light of its performance during the World War, and the Ordnance Department is today able to say, 'In the event of war, this is the shoulder rifle we will put into production, these are the standard types of ammunition for it, this is the adopted cannon for divisional artillery, this is the tank we want, etc., etc.' For each particular function a definite type has been selected to be put into immediate production in the event of war. We are not going to halt production to await the development and test of any new device however promising, but we'll go ahead with the manufacture of those we know will give reasonable satisfaction on the field of battle and, what is more important, those we know can be manufactured here in America in sufficient quantity and within a reasonable length of time. Under shelter of this program, new and experimental devices or improvements on standard devices can be tried out, not only at the proving ground but in the shop, and no dependence will be placed upon any of them until they have satisfactorily met the acid test of greater efficiency in the field and at least equal ease of production in the factory. Contracts for the manufacture of superseded weapons will be tapered off gradually, as production of the improved types gets under way. At any given time, however, there will always be a standard weapon for each particular purpose and we'll go to bat with that in the event of war.

"Not only must we prepare ourselves for possible changes in design, but also for greatly increased employment of the various types of weapons adopted as a standard. At the start of the World War, a total of 50 machine guns was the standard equipment of an infantry division. At the time of the armistice the tables of equipment called for an increase of 2060 per cent in this type of equipment. If the fighting forces determine that each squad must have two machine guns instead of one, its a simple process to rub out the 'one' and write in a 'two,' but by the time that increase is carried up through companies, battalions, regiments, brigades, divisions, corps and armies—and additional small arms ammunition provided for—we of the Ordnance have to build another city of Bridgeport. The use of ammunition in warfare is increasing by leaps and bounds. In the reduction of the St. Mihiel salient during the bombardment which lasted only four hours, more than half as much artillery ammunition was expended as was used by the whole Union Army throughout the entire final year of the Civil War.

"I have endeavored thus to reduce the ordnance prob-

lem to its essentials in order that you who have volunteered to help in its solution here in New York may have an intelligent understanding of the fundamental conditions under which we are working. This is particularly necessary because much of your work will have to be undertaken upon your own initiative, either as individuals or by the formation of committees. Your parent bodies—the great national engineering societies—are performing a great public service for our parent body—the War Department. They are studying certain critical phases of the overhead problem of industrial mobilization, and I am looking forward confidently to receiving similar assistance from the local sections in studying certain troublesome aspects of our local problem.

"The New York Ordnance District needs today expert advice on the power situation in this vicinity. In placing tentative contracts which call for increased facilities, we want to be reasonably sure that we can get necessary power when we need it. We need the counsel of men of broad vision who can tell us whether our war plans are tending to create a power shortage, and if so, what steps should be taken to avert it. We want to know whether we can count on help from the proposed Super-Power plan, or whether we shall have to depend on our own resources and ration power to non-essential industries.

"During the war, there were not sufficient heat-treating facilities in the United States to take care of the shell program as projected. We'd like to know whether that situation has improved in this vicinity and what the future promises in that direction. We'd like to know whether it is practicable to standardize metallurgical practice within the district, and if so, what steps can be taken now to bring it about in the event of war.

"Members of the engineering societies have ample opportunity to help as individuals. We are not going to make excessive demands upon their time—we'll be glad to avail ourselves of whatever time they themselves feel they can give us. The awakened interest of the great engineering societies and great industrial organizations and this readiness to help the Government prior to the outbreak of war is a tremendous asset and we should take full advantage of it. I want here to point out, however, that every scientist, engineer and manufacturer who is eligible for the Officers' Reserve Corps, should give very serious consideration to enrolling himself. It is all very well to say that 'if the Government needs me I will be very glad to volunteer.' That condition was true at the outbreak of the World War. Thousands and thousands of letters and telegrams poured in from those who offered their services to the Government. It was a most inspiring thing, but if that same willingness to serve the country had been spread over the preceding six months—if those same gentlemen had enrolled in the Officers' Reserve Corps—if they had even gone through the administrative procedure which, under the statute law, is necessary before one can be vested with the powers and responsibilities of an officer of the United States, it would have given the War Department time to sort them out, so that they could be tentatively assigned to the positions of responsibility for which they were best fitted, and our war program would have gotten under way much more rapidly.

"It's very much to our interest to enroll in the Officers' Reserve Corps—even if we do have to answer a questionnaire every now and then. If we don't enroll, we've got no kick coming in case we draw an unsuitable assignment.

"We have 17,000,000 men of military age, and we've provided West Point and other military schools, Civilian Training Camps and National Guard Armories, Reserve Officers' Training Corps and National Rifle Matches—all government-supported institutions for training in the *use* of arms—with but relatively little thought or consideration for training in the *manufacture* of arms.

"We seem to have forgotten the youngsters in the shops, notwithstanding the fact that modern warfare entrusts to them the crux of the whole preparedness program. Its easier and quicker by far to teach a man how to use a rifle, than it is to teach him how to make a rifle—just as learning to drive an automobile is easier than learning to make one. Yet we disregard not only the outstanding lesson of the World War, but also facts of everyday knowledge, and continue to focus our attention on questions of man-power, when we know full well that *munition-power and not man-power* is the critical and controlling factor in preparing for the National Defense. It would be just as logical for the Government to spend money teaching our youngsters how to make ammunition, as it is to appropriate funds, as we do now, for teaching them how to hit something when they use it. In fact, it would be a lot more logical, if we gave precedence to training in making war weapens—then, if there were any springing to arms overnight, we'd be reasonably sure that there'd be arms to spring to. As it is now, our preparedness program is critically out of balance—industry must be given its chance to prepare.

"It seems to me that we have a pretty logical case. We have unexampled natural resources; we have a manpower that is unrivaled. The thing that we need to do is to so plan, that we can convert our raw materials into finished product, in the way of munitions, so that our man-power will be matched with adequate munition power, and if we do that, it seems to me it is going to be a pretty brave combination of nations or individual nation that is going to attack us. That seems to me to be a peace plan that will work. (Applause.)

"Just one word more. I want to thank you for coming here this evening, and I want to thank Judge Gary particularly. Perhaps all of you don't know it, but he is leaving for a two months' trip to South America, and as he is leaving tomorrow or the next day, he has come here at considerable inconvenience tonight, and I think I am speaking for all of you when I say he has acted as an inspiration for us. (Applause.)

"I want to suggest that we give him a rising vote of thanks and bid him *bon voyage*, a smooth trip out and a quick trip back."

Judge Gary in adjourning the meeting said: "In behalf of the Committee, it is my right and my pleasant privilege to thank you for your presence here tonight, for your cordial support and cooperation, and to congratulate you on what you are; what you have done, and are doing; and what you will do. Addressing this vast body of men, I ask every man present, who is willing to dedicate his talents and energy to the cause of peace, even when it is necessary to fight for it at the call of Uncle Sam, to stand upon his feet!"

The audience arose and applauded, and the meeting adjourned. The cause of Industrial Preparedness had many new friends and many enthusiastic old admirers.

The West Point Museum

By

ROGER TAYLOR

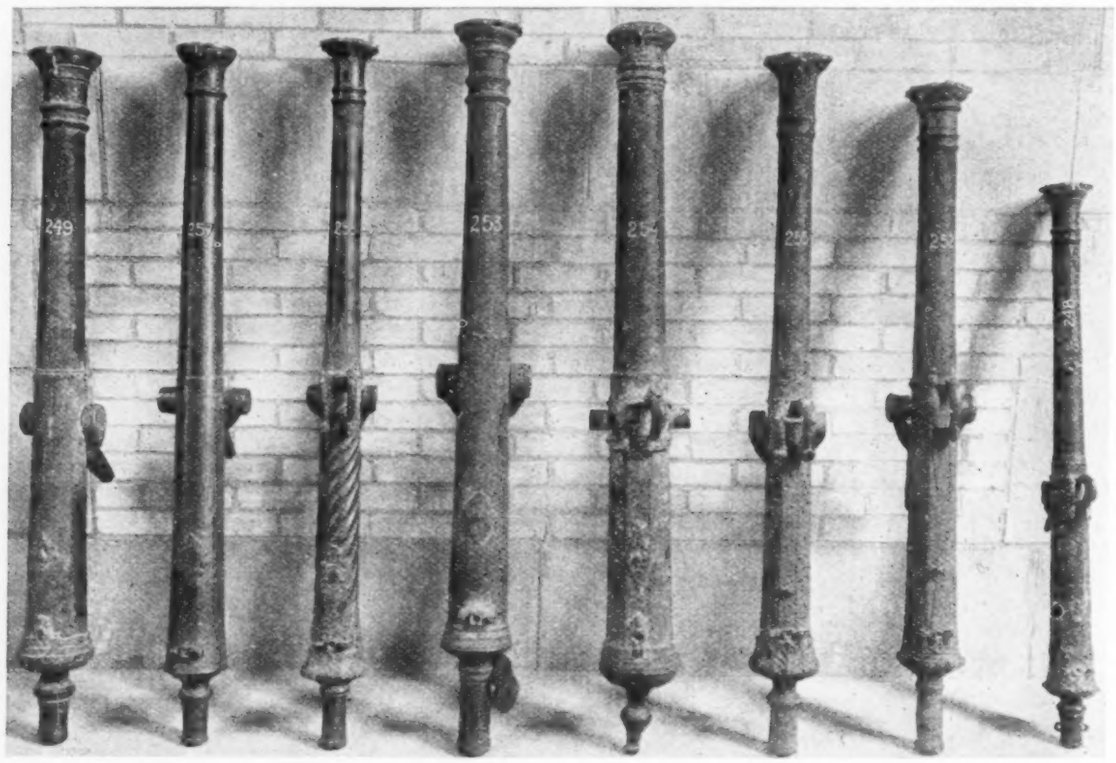
IN 1783 the Congress of the United States ordered presented to Major General Greene some of the guns captured from the English during the Revolution, "as a monument of their high sense of the wisdom, fortitude and military talents which distinguished his command in the Southern Department and of the eminent services which, amidst complicated dangers and difficulties, he performed for his country."

As early as 1823 these guns, with the permission of the heirs of Major General Greene, were deposited at the Military Academy, where later the colors taken from the English, and their so-called Hessian allies, were also deposited. About these trophies, a collection of similar articles gradually accumulated.

Boynton's "History of West Point," which was published in 1863, records the foundation of a museum at West Point as follows—"The museum had its origin in 1854, and, under the law of 1814, which authorizes the President of the United States to preserve and display trophies of war, Secretary Marcey, under date of December 28, 1848, declared: 'Among the considerations which render the Military Academy at West Point an appropriate depository of the trophies of the successful victories of our arms in Mexico is the admitted fact that the graduates of that institution contributed in an eminent degree to our unexampled career of success!'"

Thus the museum became an officially recognized institution and at the same time acquired many of the trophies of the Mexican War.

The collection of military relics, and old and new arms and ammunition is, as far as space will permit, housed in the museum proper, but a quantity of it, due to lack of space in the museum, or because of the size of individual articles, is distributed about the post, particularly at Trophy Point, Fort Clinton, and Cullum Hall. The museum for many years occupied a portion of the Academic Building but when the new Administration Building was constructed the growing importance of the museum, the only public War Museum of the country, was recognized, and a place was specially constructed for housing it. The museum was moved to its present quarters in December, 1909.



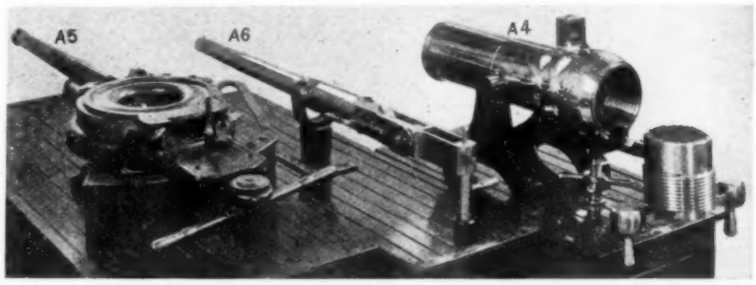
Moro Lantakas of Beautifully Decorated Bronze in the Artillery Room at the West Point Museum

The Museum is in the northwest portion of the Administration Building on the second and third floors. It utilizes about 8,250 square feet of floor space, divided into several rooms, as well as the necessary galleries, halls and stairways.

Artillery

The artillery room, which is the most imposing in the Museum, is a really fine architectural accomplishment. It

is 27 by 113 feet and reaches in height through two of the normal floors of the building. The floor is of stone, the walls and groined and vaulted ceiling are of fire brick and the pilasters and ceiling ribs of gray sandstone. The machine gun room and the flag room are also well proportioned and of fine interior finish. The other rooms occupied, while satisfactory and well designed, are not otherwise worthy of special note.



Volley and Rapid-fire Guns on Exhibition in the Machine Gun Room at West Point

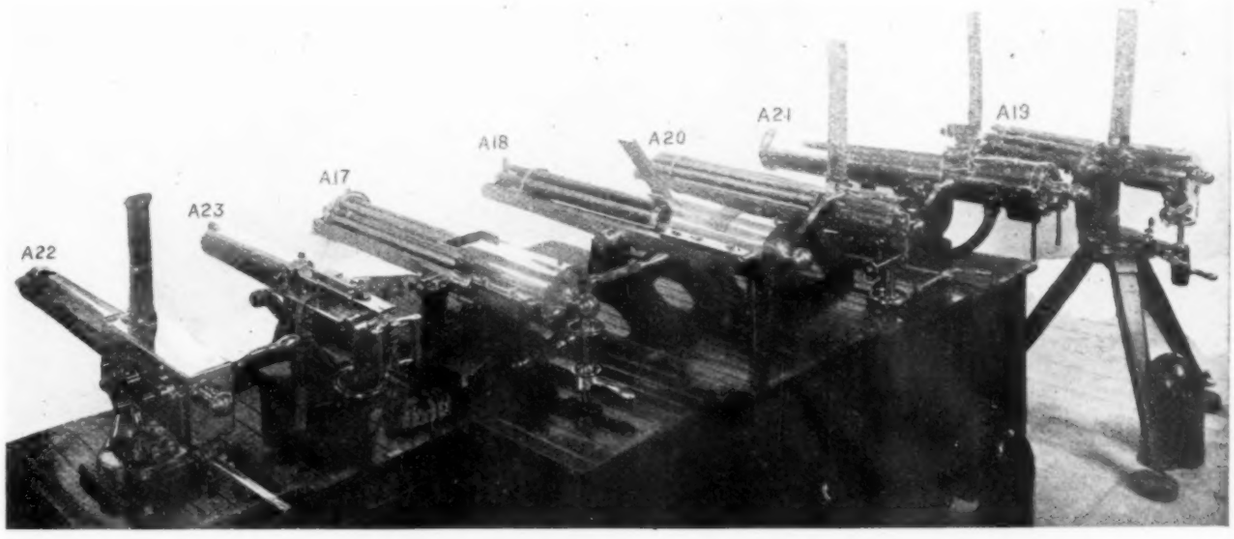
An adequate impression of the nature of the contents of the museum might be obtained from a complete catalogue of its contents, or from a more tedious partial enumeration, of what are thought to be the more important items in the collection. There is no space here for the former, and it is not probable that there is a demand for the latter. An attempt will therefore be made to reproduce the impression which would remain in the mind of a visitor after a fairly rapid tour through the museum and among the outside trophies.

The stairway and passage leading from the sally port contain some old and new projectiles, a few old pieces of field artillery of light caliber, two German spring-tired wheels which are trophies of the World War, a flag case containing Civil War flags and two old projectiles on brown sandstone pedestals, one a round shot and the other a bar shot. As projectiles, these would seem to have been so ineffective as to be uninteresting. However, as they were actually used by an English man-of-war against our own people, during the Revolution, they have a sentimental interest.

From the passage one enters the room devoted to artillery, artillery accessories of various kinds, and artillery ammunition. Around the walls is a collection of projectiles which illustrates the history of projectile design. One or two cases contain miscellaneous objects of great interest, such as, for example, the first shot fired at Fort Sumter in the Civil War. In this room one sees models of the modern disappearing and barbette coast defense guns and of the modern coast defense mortars. These models of the coast artillery material are made to 1/10 scale and are complete working models. Next to these are some models of older types of coast defense guns and mortars, showing the ingenious devices for handling by man power after guns became heavier and muzzle velocities greater than in the very early types.

After the old seacoast type guns are several full size pedestal mounts of the character in use some time before the World War—say from 1898 to 1914. These guns are of particular interest because each has a different and ingenious breech mechanism and none of them is of any of the three types that are common today. Next are the models of the field artillery types which prevailed immediately preceding the late war. These also are very carefully and accurately made showing all the details of limbers, caissons, and harness. The extreme eastern end of this room is devoted to fire control equipment, nearly every kind being represented. Here, there is also a case containing a complete assortment of lenses, prisms, etc., for these instruments.

In this artillery room there are also displayed a number of old mortars, small field pieces, small submarine mines, and miscellaneous relics and trophies. The artistic workmanship lends a great deal of interest to a number of Philippine Moro lantakas of bronze beautifully made and decorated. On exhibition in this room is also the 75-mm. gun, model 1897, No. 13,579, which fired the first shot for the United States in the World War. The shot was fired from Bathelemont, near Luneville, at 6.05 A. M., October 23, 1917. This gun fired



Various Types of Gatling Guns in the Military Academy Museum

at about this time twenty-four shots at a German battery near Xaurey, Lorraine, and fired in all 10,000 rounds between the time it was taken over from the French and the time it was determined to be unserviceable in April, 1918.

The machine gun room opens out of the artillery room

Bronze Cannon on Display at West Point

and here the history of machine-gun evolution is represented by a number of volley guns which preceded the Nordenfeldt and were tried during the Civil War. Some of these were designed for metallic cartridges and some for paper cartridges. Next are specimens of hand operated, continuous fire guns which came before the Gatling type. The early varieties represent generally what must have been complete failures. Several very good examples of Gatling and Nordenfeldt guns are in this room. Modern machine guns are thoroughly covered so that one can grasp readily the lines of thought which led to our developments of the Lewis and Browning guns of today.

Projectiles

Opening from the artillery room at the end opposite the machine gun room is the projectile room, which is small but contains a large number of projectiles of every kind, as well as fuzes. Here there are some of the large brass cartridge cases so extensively used by the Germans and Austrians on account of their breech mechanism construction, which would not hold the gases without a shell case. This feature of the German and Austrian heavy artillery made the shortage of copper from which they suffered particularly embarrassing to them.

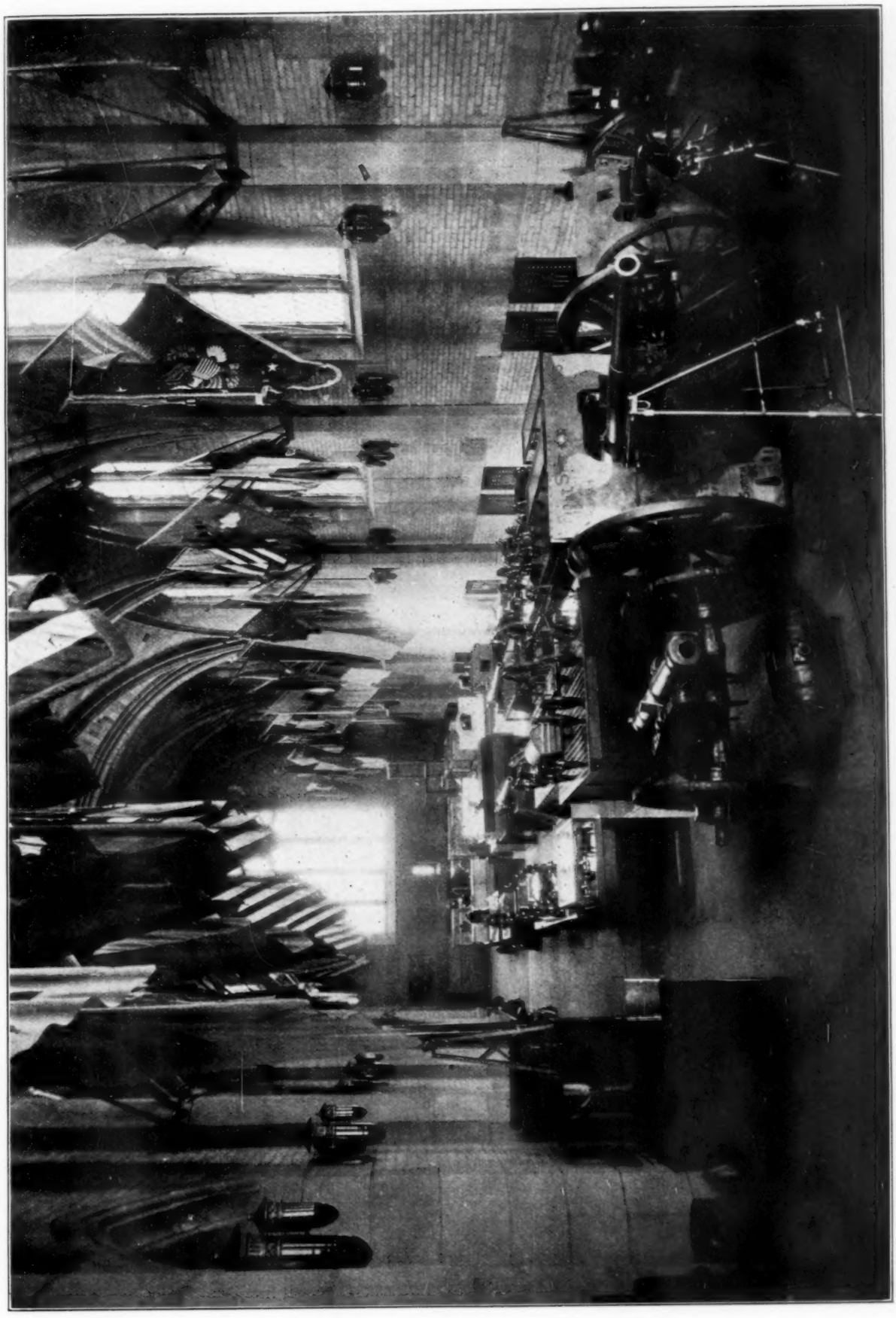
One side of the projectile room indicates development of the propelling charge and its methods of ignition, inflammation and obturation; the other, the development of the projectile from the solid shot to the high explosive, accurately-fuzed shell or bomb of today.

Of interest in this exhibit are samples of the old grape shot and cannister; old varieties of fuzes, both time and percussion; and some Civil War hand grenades, which were made with wood and paper tails, devised to make them travel nose on and properly function their fuzes.

Flags

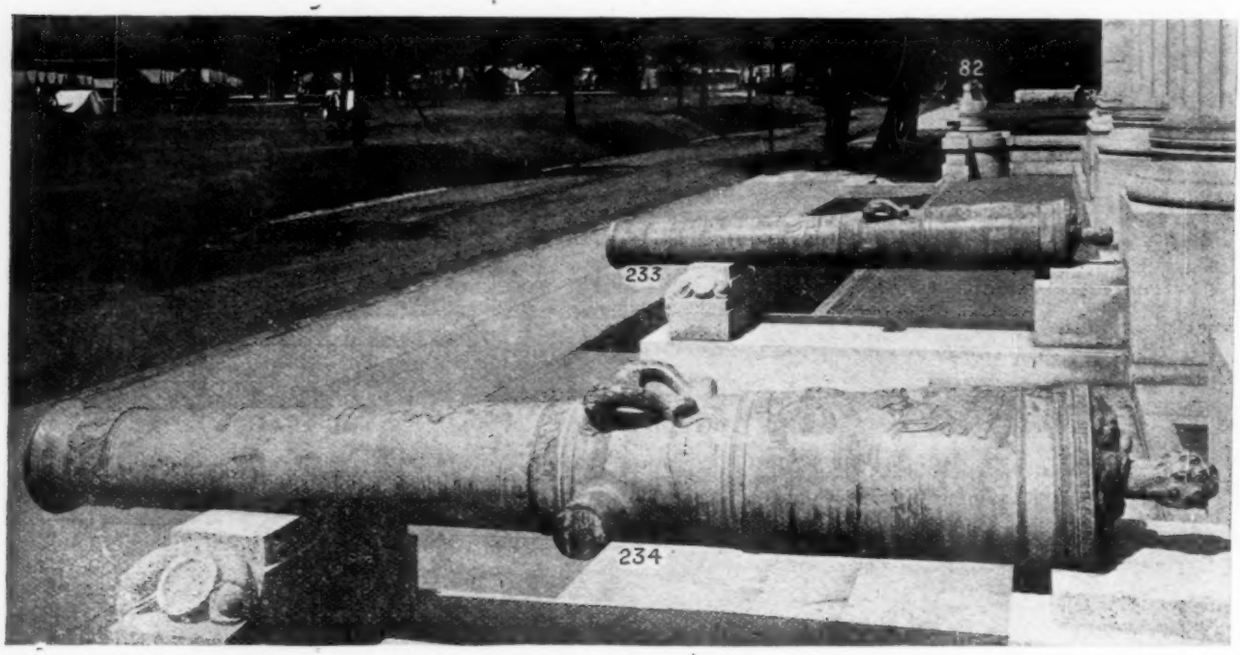
The three rooms mentioned comprise all of the lower floor. Opening from a landing one-half flight above is the flag room. This contains a rare collection, each item of which is of great historical importance. Many flags, regimental and national, representing the periods of all wars, are in this room. Of overshadowing interest are the flags captured from the British and their allies during the Revolutionary War, which have already been mentioned in this article as being part of the nucleus of the museum. The rarity of captured British flags in this country is due to the fact that many of them were destroyed in the burning of the Capitol in 1812, and the rarity elsewhere is due to the fact that in most of the wars in which English colors were lost, a clause in the peace treaty required their return. The captured Revolutionary flags at West Point are eight in number. One of these was captured from a battalion of light infantry, known as the 7th Fusileers, and was probably captured at Fort Chambly, though possibly at Cowpens. Another, which displays an incorrectly made St. Andrew's cross, English authorities declare was not made in England. It is, therefore, probably an American Tory flag. It has on it in ink an inscription which, though only partly decipherable, indicates that it was the flag of Colonel Butler's organization, notorious for its part in the Wyoming Massacre in 1778, in northeastern Pennsylvania. Several of these flags belonged to the German mercenaries; they are all of the Ausbach-Bairuth regiments and are elaborately embroidered. Some of this collection of British flags were originally the property of General Washington, and, to quote from the museum catalogue, "They were bequeathed to George Washington Parke Custis, the son of his adopted son and grandson of Mrs. Washington. He bequeathed them to the War Department, which came into possession of them in 1858. This same year Secretary Floyd had them sent to West Point and presented to the Academy."

These valuable flags were in very bad condition, some of them torn and having pieces lost and the fabric had become as brittle as dried leaves. They have all now



The Artillery Room in the Military Academy Museum. In the right foreground is shown the 75-mm. Gun which fired the first shot for the American forces in the World War

been preserved in a most ingenious and permanent manner by quilting them between pieces of black silk net. This work was done by an expert needle-woman, who had rare experience and deftness in this work. The labor-



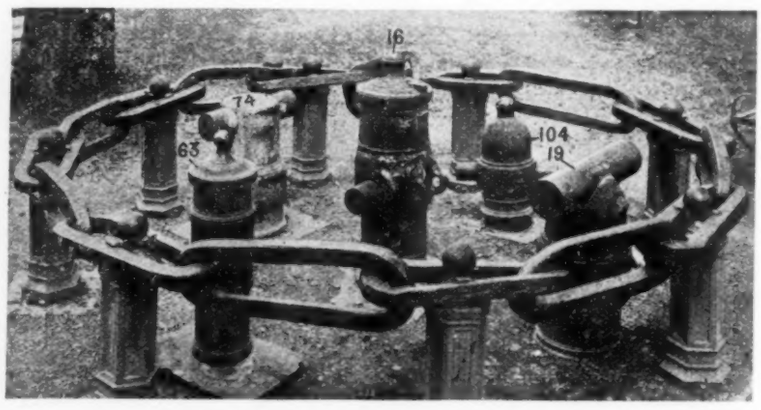
Bronze Guns at Entrance to Memorial Hall, United States Military Academy

alone, with all materials found, on each one of these flags cost about $200.00.

The flag room also has a collection of flag-staffs or sections of staffs—one from each of the important Mexican strongholds between Vera Cruz and Mexico City—which were seized by our forces in the War with Mexico, and a full case of captured Mexican flags.

A small side room at the top of the stairway is known as the manufacturing room. And here, in passing, it may be noted that the walls of the stairway and landings make a very satisfactory place to hang portraits of persons of particular interest to West Point or the service, who were not graduates of the Academy and whose portraits are accordingly not suitably placed in the Cullum Memorial to graduates.

In the manufacturing room are exhibited models of machines of special use in ordnance manufacture. Among these are two beautifully made working models, one of a gun lathe and one of a boring lathe for large caliber guns. On each of these machines is a gun shown in process of manufacture which was actually bored or rifled on the model machine. This room also shows the field gun shell and case, fuzes, small arms cartridges, and the Springfield rifle, each in the various stages of manufacture and completion. The gallery which leads to the next room has several cases against the wall containing some of the smaller hand arms. Early pistols of many sorts, and later types attempting multiple fire, make apparent the development leading to the modern revolver and automatic pistol. The recent arms are represented in sufficient numbers to show the various slight changes in the United States service weapons. Farther along are knives of every sort used in warfare by savage and civilized people, also war-clubs, axes and tomahawks.



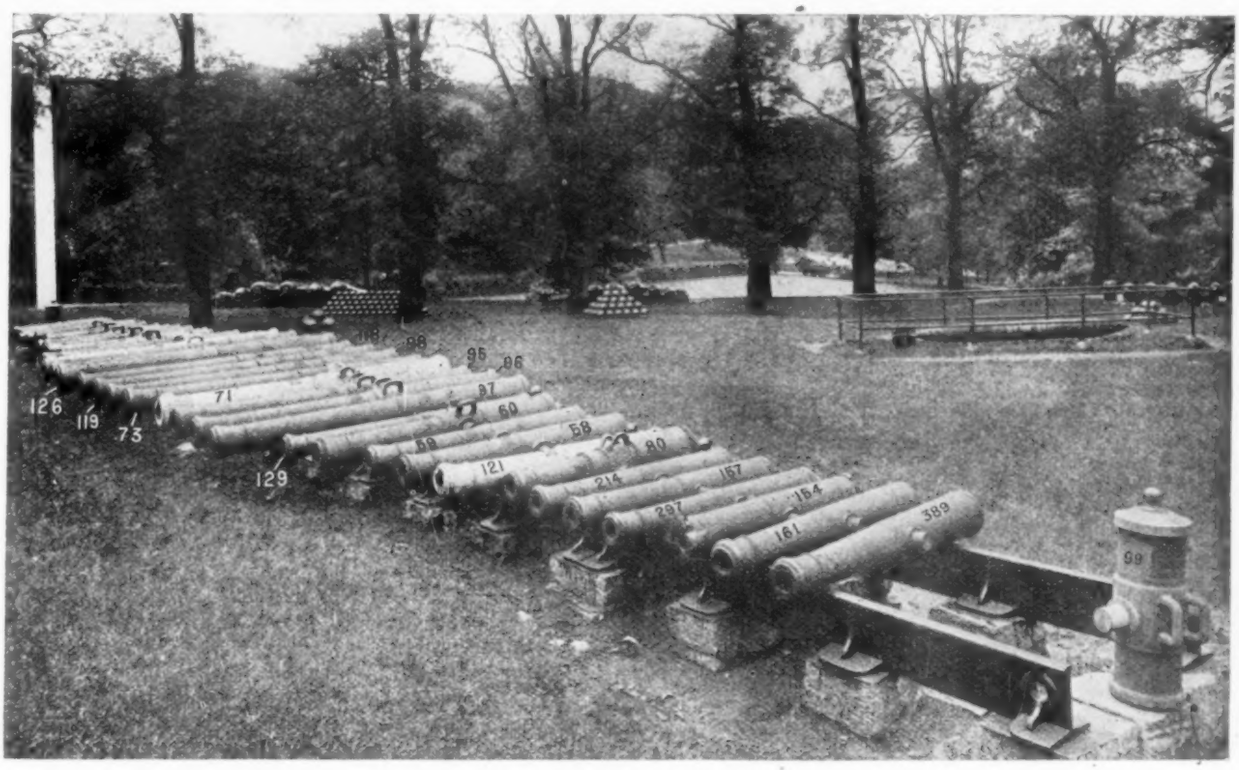
A Section of the Chain which was Stretched across the Narrows of the Hudson to Prevent British Men-of-war from Ascending the River

Small Arms

This gallery leads to the small arms room, in which hand arms of all descriptions are collected. The walls are covered with swords, lances, battle axes, pole axes, halberds, etc. On the walls are also suspended some suits of armor.

The especially fine or valuable swords are contained in several cases. Many of them were presentation swords to distinguished graduates of the Academy. Particularly noticeable among these, on account of the fine materials and workmanship that went into their making, are those of Brigadier General W. W. Burns, Colonel Sylvanus Thayer and Captain C. F. Smith. General Burns' sword was presented to him by the non-commissioned officers and privates of the 72nd Regiment, Baxter's Fire Zouaves, 1863. Col-

onel Thayer's sword was presented in 1853, by the eighteen survivors of the class that entered the Academy in 1817. Captain Smith's was prsented by his fellow citizens of Philadelphia. Some of the presentation swords on exhibition are the property of the museum and some of them have been loaned by their owners. Of greater historical interest is a sword worn by Kosciusko while in this country, which he presented to Colonel John Byard. It was bought by the Military Academy at a sale of the effects of one of Colonel Byard's descendants. This sword is of Toledo make and is inscribed, as are many Spanish swords, with the Spanish motto, which, translated, means "Draw me not without cause. Sheath me not without honour." In the same



An Exhibit of Guns Used in the Mexican and Civil Wars

case with Kosciusko's sword is a book which he wrote and which was published in this country, entitled "Regulations for the Manoeuvre of Horse Artillery."

Among the swords is placed a lantern, owned and used by General Grant at Appomattox. It was presented to the museum by Mrs. F. D. Grant as a gift from her husband, General Frederick D. Grant.

Elsewhere in the museum is a uniform of General Grant which he wore during the Civil War and a pair of field glasses and some of his other equipment.

The remainder of the small arms room is devoted chiefly to various types of rifles, shotguns, and the older smooth bore weapons which often served the purpose of both of these arms. In this collection the story which starts with the smooth bore, matchlock, muzzle-loading musket and ends with our present Springfield rifle can be followed. The preface of this story can also be seen in the cross-bow, and the still earlier bow and arrow as well as blunderbuses, caribines, combination arms, and ideas which reached the stage of being marketed and used.

The great efforts that have been made between the Civil War period and the present time to secure increased rapidity and accuracy of fire, higher muzzle velocities and still to maintain or improve the ruggedness without increasing the weight of small arms and the effort to save money by modifying the stock on hand, are illustrated by hundreds of rifles well arranged in racks throughout the room for this purpose.

Capt. G. H. Hall, while an employee at the Government Arsenal at Harpers Ferry in 1813, did pioneer work. His influence on the development of the rifle and other firearms from that time until the middle of the last century was most important. The racks in the small arms room show examples of his designs, which indicate the steps which he took toward improvement. The early breech-loading types with flint lock of his invention are succeeded by his breech-loading precussion locks and further improvements on the latter.

Hall exercised a more important influence on American industry than is generally appreciated. His early and successful efforts toward obtaining interchangeability of parts in the military rifle was an example which lead to one of the present cardinal principles of the best American mechanical manufacture.

Several rifles and carbines represent the attempts to introduce the revolver principal by Colt in 1857. One can see here the Prussian Needle gun which was a step between the precussion lock and the modern bolt action rifle with metallic cartridge. This needle gun was used by the Prussians in 1870.

Foreign military rifles, of both the older and the modern types, are fully represented in the collection. Particularly useful for purposes of study and comparison is one rack containing the rifles of most of the more important nations at the time of the World War. This rack holds, in all, some 24 pieces.

cabinet containing some of the finer and rarer items of the Whitehead collection which was presented to the museum by Mrs. W. R. Whitehead, the widow of Dr. W. R. Whitehead who formed the collection.

Here are many objects of military significance. Among others is an English cross-bow, handsomely inlaid with ivory, with the date 1617 on the end of the stock. Another weapon worthy of special note is a match-lock gun from India with heavy silver bands on the stock and the barrel damascened with gold. There are twenty or thirty other articles in this case which are of great variety and of a beauty comparable with that of those mentioned.

The last room beyond the small arms room is called the Indian Room and there is here an assortment of Indian relics, trophies, and mementoes of Indian campaigns, also there are numerous Philippine articles and some from Mexico, as well as a few which cannot be classified with any other group in the Museum. The diversity of the exhibits here is so great that no attempt can be made at a general description. Instead only a few outstanding and unrelated features will be mentioned.

Great quantities of Indian bead work of the finest type was sent in by officers engaged in Indian Wars. We have for instance the wedding dress of Eva Geronimo with its little brass bells. The Filipino miniature house and sugar mill sent here by officers who were in the Philippine War. There are fine examples of Chinese saddles from the Boxer Rebellion, etc.

Of the many bows and arrows (the walls are decorated with them and most of the exhibits have interesting stories) one case containing a bow and several arrows especially attracts the attention. The arrows were taken from the bodies of soldiers of Custer's command at the battle of the Little Big Horn.

Four rare pieces of Aztec pottery in a splendid state of preservation are important exhibits. They are of elaborate workmanship and have a fine black glaze. Not only are they of archaeological interest but they have an added significance in that they were found while digging trenches during military operations in the Mexican War.

There is much material in this room as well as in the rest of the museum of as great or greater historical interest than the things mentioned, but the exhibits are so diverse that only what chiefly struck one observer's eye has been described in this limited article.

Outside of the museum are some of the best trophies at West Point, such as fine bronze guns from the Revolutionary War and of the Mexican War period; a section of the chain that was stretched across the narrows to prevent the English men-of-war from ascending the Hudson river. This is part of the tragic story of Benedict Arnold's treason. The Civil War is represented by many cannons of all calibers and the World War by Austrian and German pieces of artillery which are in Fort Clinton (a part of the West Point reservation).

An imposing Civil War relic is the 150-pounder Armstrong gun at Trophy Point. This gun is supposed to have been made in England for the Confederate coast defense and was at Fort Fisher at the time of its capture in 1865. A letter written only a few years ago by a member of the force which captured the fort speaks of the Armstrong gun as being "the most formidable piece of artillery of that period" and he mentioned "its unique mounting on a carriage of mahogany and teak." This carriage, due to deterioration from exposure to weather, has had to be replaced several times and though the material is different the design is the same as the original one. From the same authority just mentioned we have the interesting information that "at this time" (the time of capture) "there was a bronze tablet . . . attached to the right side . . . with the inscription 'Presented by the Ladies of London.' " The tablet, however, has never been with the gun since it came to West Point.

From the World War there is, among other captured guns, a 350-mm. German howitzer on a most elaborate and solid mount.

In the museum, at Fort Putnam and Fort Clinton the development of artillery can be followed from the very early breech-loading guns, through the period where muzzle-loading and a permanently closed breech had to be resorted to, down to the modern 6-inch breech-loading disappearing guns emplaced at Battery Schofield.

Among the trophies not mentioned elsewhere are also what is known as the Crown Prince's periscope which is a very long instrument permitting a view of a field of operations while the observer is well under cover. Some fine bronze cannons which are here illustrated, and some 12-pounder bronze cannons inscribed as follows, "Lost without dishonor at the battle of Buena Vista by a company of the 4th Artillery. Recaptured with just pride and exultation by the same regiment at Contreras."

It is hoped that this description of the museum will give to the readers of ARMY ORDNANCE an adequate idea of the scope of the exhibits. In conclusion it seems fitting to impress upon all interested the special need and uses of such an institution in connection with West Point. The museum and trophies occupy a most important position at the Military Academy where, first of all, they furnish an inspiration alike to the officers of the post and to the cadets, reminding them of the high standards and fine traditions of the men of the military service of past generations and the beautiful setting here is a fitting one in which to display to the people of the country the cherished souvenirs of our history.

Until the country is aroused to the value of a war museum which can record the trials, sufferings and successes of the forebears who have built the United States of today for those who will enjoy its greatness tomorrow, the West Point Museum must serve as this reminder. It is open to the public for this purpose and is visited by thousands of interested people every year.

Perhaps the most important function of the museum is in connection with the teaching of ordnance and gunnery and other related subjects. Not only can the history and development of modern armament be taught and illustrated by the collection, but, based upon a complete accumulation of the most up-to-date advanced types, present day ordnance can be explained with thorough illustration.

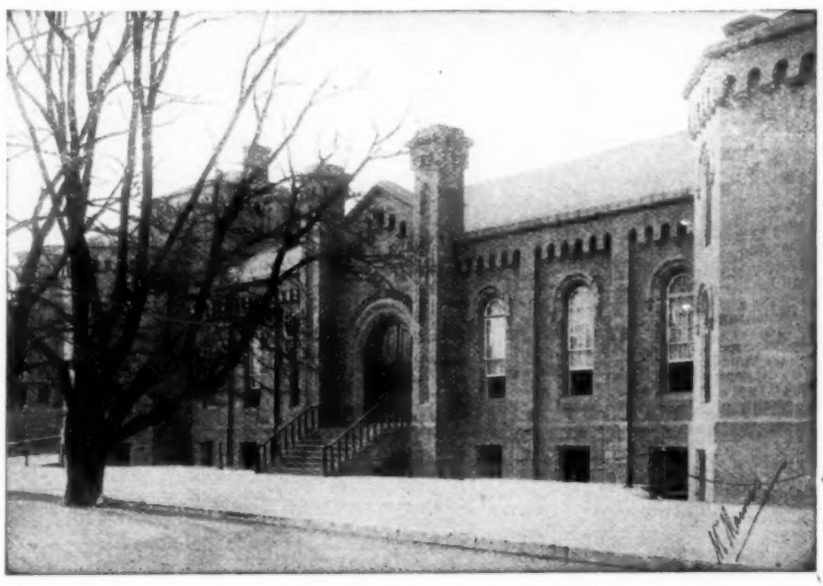
The museum having already become somewhat crowded and the collection being more diverse in its character than is to be expected in an institution calling itself an ordnance, a military, or even an historical museum, donations and loans are not generally solicited. None the less there will always be room and gratitude for really rare articles of historical and military interest in the West Point Museum.

The Military Training of a Cadet at West Point

By

O. J. GATCHELL

THERE are many more pleasant experiences in life than that of arriving at the United States Military Academy as a new cadet. On the first of July of each year, West Point is invaded by about 300 or more aspiring soldiers, gathered from all parts of the United States, and from all walks of life. One by one they report at the Administration Building, where they are checked off by the clerk, and then escorted by an orderly to their first experience in an entirely new life. This first experience assumes the form of a dapper cadet who greets them all alike. It matters not whether the newcomer be the callow youth fresh from high school and far from home—the sophisticated sophomore from Harton College who has forsaken law for the sword—the son of a backwoods lumberjack or a coal miner wearing a bewildered expression—the spoiled son of wealthy parents trying his best to appear nonchalant—the enlisted man from the Regular Army or National Guard who has won his appointment by competitive examination—or the football hero of Squeedunk High School who has come to help the Army team, and expects to be hailed with the admiration due so important a personage.



Grant Hall

When the big copper name-plate over the door was first installed the Cadets were so incensed over the change of name that the inscription was taken down and concealed for a long time. "Mess Hall" was a good enough name and they thought the name of the great general to be more suitably applied to a greater structure

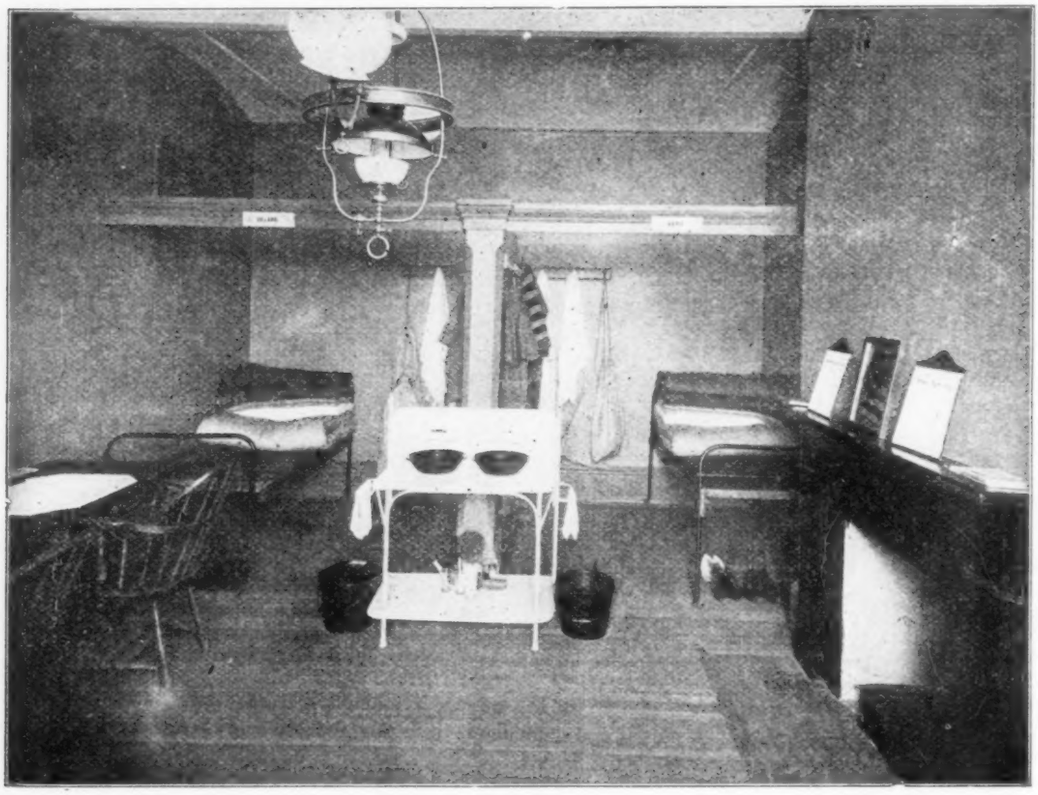
Democracy of the Corps of Cadets

To the cadet, they are all alike, New Cadets, or in cadet slang, "Beasts." He quietly but firmly instructs them how to report to the registering and assigning officer, the necessity of saying "Sir," how to salute, etc. He orders each to put his hat on straight and button up his coat; if wearing a fraternity pin, to take it off. There are no fraternities at West Point. The Corps being composed of men with a common interest in life and living in the closest relationship with one another forms one huge fraternity whose bond of fellowship requires no secret oaths. The experience which the Cadet passes through at this moment, right at the outset of his career, is very important and one of the things which help make West Point what it is. Contrary to what many of the unthinking believe about West Point, it is really the most democratic school in the world. From this point forward, these men will stand on their own feet. They will be accepted as men—not boys—and treated as such. No one will care who they have been or where they are from. The only thing that will matter is what they can show that they *are*. For the first year they will be known as "Mr. Ducrot," "Mr. Dumbjohn," or as "You Plebe." Even their names are of no importance to older cadets, notwithstanding that one might have been "Jones, of Jonesville." They are "Beasts" or "Plebes" because of the plebian rank which the first year men have. Officially, they are 4th Classmen. "Mr. Ducrot," as we will now call him, reports in proper form to the officer in charge, and is informed that he has been assigned to the 1st Company, and will, for the summer, live in Room 132. This assignment has been previously made. The 1st Company is comprised of plebes who will later be in "A" and "B" Companies when they join the rest of the Corps. When the Corps is all together there are twelve companies. Assignment to companies is made according to height, "A" and "M" being the tallest, or "Flankers," and "F" and "G" being the shortest, or "Runts." By this method uniformity of appearance is obtained and one-twelfth of each class is in each company. The twelve companies, when assembled, are treated as a regiment with a complete quota of Cadet Officers and Non-Commissioned Officers. The Regimental, Battalion, and Company Commanders, the Regimental and Battalion Staffs, and the Company Lieutenants and Sergeants are chosen from the senior class. The Corporals are selected from the next senior. All selections are based upon demonstrated military efficiency.

The plebes live by themselves in barracks during the

summer, while the 1st (Senior) and 3rd (Sophomore) Classes are in camp at the other end of the parade ground. The 2nd (Junior) Class is on furlough. Six specially selected 1st Classmen live with each plebe company to act as assistant instructors during the summer. Three act as such each day, while the other three attend drills and instruction with their own classmates. These men lose some of their first class training, but more than make up for it by the experience they have in training raw material. The New Cadet instruction is under three army officers to each company.

The assignment to Room 132 means that Mr. Ducrot is going to live in the first division, on the third floor, in room number two. The barracks, four stories high and two rooms deep, are arranged in a quadrangle surrounding the "Area." They are subdivided into "Divisions" of thirty-two rooms each, four rooms to each floor, each room opening out of a central hallway.



Interior of a Cadet's Room

Friendships formed here last forever. The new construction has carried out the same room arrangement. Where three cadets are assigned to one room, as is now necessary, one bed is fastened above the other as in a sleeping-car

But before Mr. Ducrot has really any time to investigate just what his new abode is like, he is peremptorily ordered to "Step Out" and get over to the Cadet Store where he is issued his bedding, some clothing and room furnishings. He carries these back to his room himself at a double time. (Beasts are not permitted to walk.) His clothing is simple at first, consisting of a gray flannel shirt, black tie, campaign hat and gray gymnasium trousers. Later he will be fitted to a cap, shoes, and a "plebe skin," an unlined gray service, or "Dress," coat, which is ready made and must serve him until his made-to-measure uniforms of all kinds are completed. Also he gets belts, belt buckles, etc. On the back of his white belt he prints his name in letters an inch and a half high for identification.

His bedding consists of a mattress, comforter, two heavy blankets, a pillow, sheets and pillow cases. He also is issued a water bucket, wash basin, broom, and a few other necessary articles.

How Cadets Live

When Mr. Ducrot gets back to his room he is much impressed with its plain aspect. The callow youth feels that he is farther away from home—the spoiled child is disgusted—and the football hero becomes quite convinced that he "is too good for the place." The rooms are arranged with the idea of two cadets to a room. The front portion, which is common to both occupants, contains a table, chair, and steel wall locker each. Also a washstand large enough for the two wash basins. On each side of the wash stand are placed the just-received water buckets, one for fresh water and the other for waste. In the hallway of each floor is a sink with hot and cold running water from which cadets get their supply. They are not permitted to wash at this sink in the hall. But even at that, it is better than being required to climb down and up three flights on a cold winter morning, run across a frosty area to an ice-covered spigot and there fill one's bucket with polar (not Poland) water. After pouring this over the radiator it becomes lukewarm enough to shave with. And this custom was in vogue not so many years ago. The toilets, baths, and lockers for athletic clothing are now located in the basement of each division, whereas the former used to be in a separate building in the area at the time of the water carrying mentioned above.

The rear part of the room is divided into two alcoves by a partition which extends about two-thirds of the way to the ceiling. In each alcove, which is the Cadet's private boudoir, is a regular Quartermaster bed, and on the partition are hooks for hanging clothing. Incidentally, the bedding has to be folded in a prescribed manner from immediately after reveille until a half hour before taps. Also, each of the hooks has its regular assignment of clothing to be hung thereon, and a mistake means a report and punishment. There are no rugs, pictures, or any other luxuries. Underwear, handkerchiefs, belts, etc., are piled with scrupulous neatness in a prescribed manner on shelves in one side of the wall lockers, and the other side is arranged for coat hangers—and again carelessness in arrangement means punishment. On the mantel-piece is

a small mirror and an alarm clock, issued to the occupants jointly, and a printed card known as "Hours of Instruction" for each occupant, upon which must be marked where he is, if absent from his room during "Call of Quarters." For example, if at recitation or the barber shop, his Hours of Instruction must so indicate. If caught absent without authority, it means punishment.

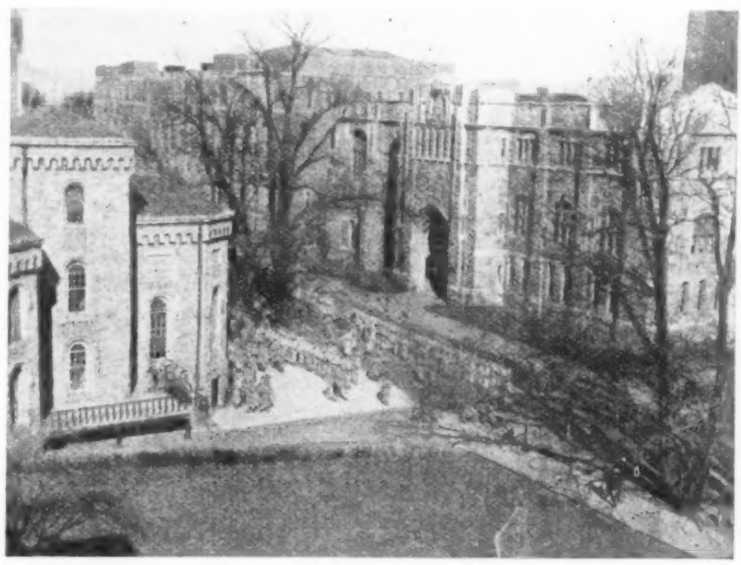
It would appear from the above that the living conditions of a Cadet are at least not sumptuous, and when you add the fact that the Barracks are planned to house about 900 men, and the present strength of the Corps is over 1,200, instead of being merely a matter of making men accustomed to simple living, it becomes decidedly a matter of sanitation and inconvenience as to studying conditions, to have three men cooped up in a room originally meant for two. More barracks are imperatively needed!

Barracks

Each division has four rooms on each of four floors. Three divisions are assigned to a company of about 100 Cadets. The classes are distributed by choice through each division with about an equal proportion of each class in each division

Living conditions are quite different in camp, although the same rigid rules as to neatness and regularity in the care of equipment and clothing apply. There are six cadets to a pyramidal tent, the tents grouped by companies as in the Regular Camps. There are buildings with shower baths and toilets at one end of camp, and spigots for water supply at the end of each company street. Camp cots are used and in general the conditions are the same as those under which the Regular Army lives in semi-permanent camp.

Before Mr. Ducrot and his roommates have much time to settle their new home, they are turned out again and get their first drill. This consists of instruction in marching, halts, facings, etc., so that they will be able to march to dinner. Cadets march to and from all meals. The first dinner formation finds the widely assorted collection of men who arrived earlier in the day already assuming the homogeneous whole which characterizes West Point. Even a fond mother would have difficulty in picking her darling boy from the ranks marching by. With the First Classmen living with them acting as officers, and guides picked from men who have had previous military experience, the new class, assembled for the first time as such, makes quite a creditable showing. But fond son, getting his first lesson in "bracing," now has his chin pulled in to learn to carry his head erect, has his shoulders pulled back until his blades are touching, and his stomach pulled up and chest thrown out like a pouter pigeon. In uniform like all the rest, he looks quite different than he did when he arrived a few hours previous.



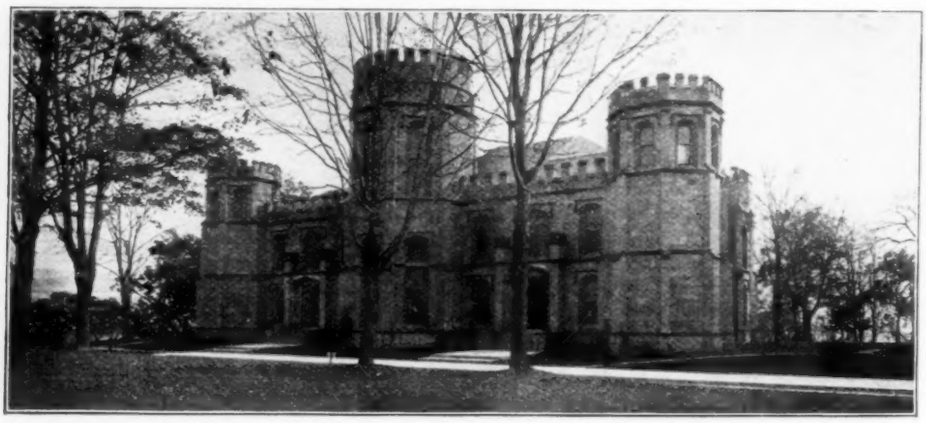
Formation After Meals

When a meal is concluded, the first battalion to enter the Mess Hall is called to "Attention," rises, forms outside, and is marched to barracks. The others form likewise in succession. The sally port across the street leads into the headquarters of the post: the entrance to the Ordnance Museum is just within the sally port

On arriving at the Mess Hall, Mr. Ducrot finds that he is seated at a table with nine others. During "Beast Barracks," as cadet slang styles the time plebes are separated in barracks from the rest of the Corps, he finds that eight of these are fellow plebes. The ninth man is a First Classman, one of the detailed assistant instructors. But the normal condition which will exist when he joins the Corps, will mean an even sprinkling of all classes at each table.

There is a First Class Cadet Officer or Non Commissioned Officer as Table Commandant. He is responsible for the discipline and manners of the men at the table. Men who come to West Point without the advantages of a careful bringing up in table conventions, are by example, and private and kindly admonition if necessary, taught table manners. All are required to sit erect and be orderly. There are usually at least three plebes at each table who act as "Gunner," "Milk Corporal" and "Coffee Corporal" respectively. The duties of the "Gunner" comprise supervision of the waiter and proper supply of the table, carving, serving, wherever division into shares is necessary, and being a general source of information as to how many days there are to June, Navy Game, Christmas, Graduation,

etc. The "Coffee Corporal" is responsible for keeping cups supplied with coffee or cocoa, and the "Milk Corporal" for keeping glasses filled with milk or water. Plebes are not permitted to "gaze around the Mess Hall" but are required to "keep their eyes on the table," a violation of this custom usually resulting in being required to count grains of pepper scattered on the table in front of the offender. Plebes are required to consider the upper-classmen as superiors, and wait until they are served. They do not address upper-classmen without permission, nor do they talk to each other unless in performance of their work. A mild sort of badinage takes place in the Mess Hall, the plebes being required to recite what their home newspaper wrote about them when they came to West Point, or some other equally foolish stunt, which usually in the long run affords the plebes, other than the victim, as much fun as the others. The Table Commandant, however, sees that this is not carried to any extreme, and that the plebes have ample time to eat heartily.



Library

This building is exceptionally well stocked with books and publications for the enlightenment and entertainment of the cadets. It contains several memorials, notably tablets erected to the memory of James McNeil Whistler and Edgar Allen Poe and a number of portraits of men who have served the Military Academy with distinction

The food, as a rule, is plentiful, well cooked, and of a fair variety. Emphasis is placed upon its being substantial. At present, particularly, under a very efficient Mess Officer, the diet is well balanced and attractively served. It is a difficult problem to feed well on the cadet's ration allowance, which is 80c per day. The average cost has been about 94c and the Cadet pays the difference from his salary. A recent Act of Congress, providing funds for the preparation and serving of the food, is expected to make it so that the allowance will not be exceeded.

The Mess Hall at the present time is very much overcrowded, as the Corps of today is much larger than was ever anticipated in the middle of the last century, when the Mess Hall was built.

First Summer Training, or "Beast Barracks"

From this time on during Plebe Summer he progresses rapidly. The first day has been described in considerable detail because it is probably the most important day of the entire four years, and in it he learns more than during any other day in his life. The next few weeks are hard—very hard. The instruction laid out for him by the Tactical Department will occupy practically every minute of his day from reveille at 5:20 until taps at 9:00. Only on Sunday will he be permitted to write home. At night he will be very tired and probably at times discouraged. But the man with the right stuff in him keeps plugging, and if he can't stand the gaff, it is better for him and for the Army that he resign early in the game. But surprisingly few do resign and when the end of August rolls around and he joins a company containing men of the other three classes, he knows how to play the game very well, and can go to drills and parades with full confidence that he can do his part to keep up the record of fine military appearance that West Point has. Even the football hero realizes that there are things which West Point has to teach, which have not been contained in his experience of life and decides to stick it out.

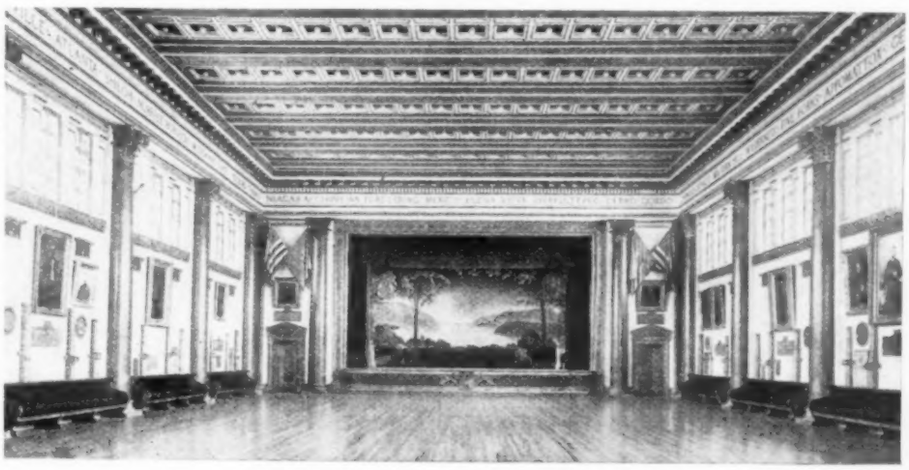
From a military viewpoint, during these two months of intensive training he has been taught Company Infantry Drill very thoroughly from the viewpoint of the man in ranks, including some extended order, tent pitching, etc. He has been taught guard duty and has actually served at least one guard tour in camp with the upper-classmen. He has had some instruction in the elements of Minor Tactics; has been taught how to care for and aim his rifle; has been taught military courtesy and army customs; and has had instruction every day except Sunday in physical training and calisthenics. At the end of summer he has gone on a week's practice march, which has been made in easy stages, and during which he has been given considerable freedom. This has served to give him instruction as to the conduct of marches and also as a sort of vacation and recreation after a hard summer and before tackling the new problems of academic work and other winter instruction.

During the summer he has been permitted to go with classmates on Sunday evenings to hear the "Color Line" concerts in camp. These are informal entertainments given by the cadets themselves, and get their name from an old custom of giving them where the colors were placed on the rifle stacks in the old days, when all rifles were stacked for the day after troop parade in the morning. Some of these concerts are rather good and are always full of local color.

At the end of camp is Camp Illumination. Here the plebes get their first social contact with the upper-classmen. Hitherto they have performed guard duty and gone to parades with them. For a week or more ahead there is lots of work. For example, last year's Camp Illumination consisted in fixing up the main street of camp, known as the General Parade, as a western "cow town," and the entertainment consisted of a very creditable wild west show, followed by a dance. This function dates back to the first Camp Illumination which was on a very grand scale to celebrate the birth of the Dauphin of France. The plebes turn to with a will and do much of the work of preparation, but are rewarded by being given upper class privileges for that evening. They participate in all the functions of this occasion with relish.

Comparison of West Point With a Training Camp

At this point in his career Mr. Ducrot has become quite a fair soldier, and a few months more like it would make him a good second lieutenant from a strictly drill master viewpoint. After the World War, during which the success of the Plattsburg method of training was demonstrated, many people asked, "Why should we have West Point? Why not have all officers educate themselves at college at their own expense, and then learn their duties as officers by a short, intensive course of military training?" One very obvious and all sufficient answer is that if this method of recruiting officer personnel were used *exclusively* it would destroy the democracy of the Army, and restrict its officers to a class of men who could afford a college education. Most European armies require their officers to be of independent means and their commissions are purchased. If there is any justification in the talk of so-called "Military Aristocracy," that is a fundamental reason. Our Army prides itself upon the fact that its officers come from all walks of life, and wealth and family give no prestige whatsoever.



Main Room of Cullum Memorial Hall

Cadet hops and other entertainments throughout the year, including "The Hundredth Night Show," are held here. The hall is beautifully decorated with portraits bronze tablets, and old bronze guns set in the walls

There is another reason which cannot be so briefly expressed, but is based upon the fact that most of those who ask the questions above, believe that the rigorous military training which a cadet receives at West Point, and the length of time devoted to it, are for the purpose of turning out a sort of super-second-lieutenant. In this belief they are entirely mistaken. Plattsburg turned out excellent second-lieutenants and other officers for particular grades in particular branches of the Army. As a contrast, West Point trains men more fundamentally for *all* branches. Many Plattsburg graduates, because of natural ability, became just as efficient officers as those who had the advantages of more thorough military training. Many of the finest officers of our Army were commissioned directly from civilian life with no previous military training whatsoever.

But the traditions of our service require something more of the commissioned personnel than mere skill in military tactics. The highest standards of honor and loyalty, and discipline as a *habit* of life, are more important in the American ideal of any Army Officer. A man may or may not possess the former naturally, but the latter can only be acquired by long training. Year in and year out there must be added to the commissioned personnel of the Army enough of those who have had the kind of training West Point gives, to act as a leaven to the whole. The point is, that without West Point, Plattsburg could not have been nearly as successful, nor could the officer commissioned directly from civilian life be the fine type of officer he is. Both he and the Plattsburger unconsciously assimilate the highest ideals of our Army, which are treasured and fostered at West Point.

It is a well known fact in the business world that many so-called "self-made" men, through sheer ability and will power, rise to great heights without the benefit of a college education. But the fact still remains that as an *average* proposition, the man with the most complete preparation will be the most successful.

The same thing applies to Military Training. The *average* man of the type suitable for an officer in the American Army, will make a better officer with the benefit of four years careful training than he will without it, and the purpose of West Point is to give that kind of training to the average man.

The following quotation from a report of the Academic Board clearly defines the purpose of the military features of a Cadet's training:

> "The purpose of the Military Training at West Point is to give to all cadets a broad general conception of all branches of the service and of the function of each branch in the organization of the division, corps, or army. Attention is invited to the fact that this training is elementary, fundamental and general. The tactical work is not intended to produce glorified drill sergeants, or to qualify the cadet to be a subaltern officer in one particular branch of the service. As stated, the training is planned to impart a general conception of all branches and of the special function of each branch."

Discipline—What It Means

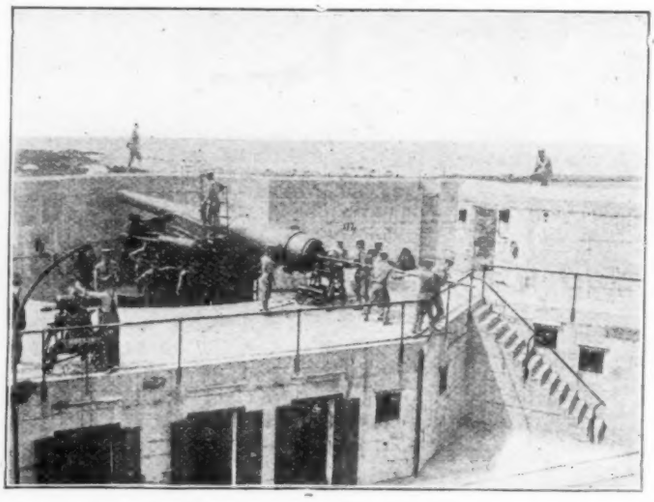
Now why is the inculcation of discipline so necessary in a *real* military training? Below is quoted what Maj. Gen. John M. Schofield said in an address to the Corps of Cadets on Aug. 11, 1877.

> "The discipline which makes the soldiers of a free country reliable in battle, is not to be gained by harsh or tyrannical treatment. On the contrary, such treatment is far more likely to destroy than to make an army. It is possible to impart instruction and to give commands in such a manner and such a tone of voice as to inspire in the soldier no feeling but an intense desire to obey, while the op-

posite manner and tone of voice cannot fail to excite strong resentment and a desire to disobey. The one mode or the other of dealing with subordinates springs from a corresponding spirit in the breast of the commander. He who feels the respect which is due to others cannot fail to inspire in them regard for himself, while he who feels, and hence manifests, disrespect toward others, especially his inferiors, cannot fail to inspire hatred against himself."

How the Daily Life of a Cadet Inculcates Discipline

Mr. Ducrot has reveille at 6:00 A. M. This usually means roll out of bed a few minutes before assembly and hastily don underwear, socks, shoes, trousers, coat with collar and cuffs attached, and cap. Then he has 30 minutes until breakfast, during which time he is expected to fold his bedding, wash, shave, shine his shoes, etc., and if room orderly (which duty he shares with his roommates a week at a time) sweep his room. At 7:20 the cadet non-commissioned officer in charge of quarters inspects to see that the room is swept, in reasonably neat order, and the bedding properly folded and piled. So accustomed do cadets become to speeding up these duties that their efficiency as to wasted effort out-Taylors Mr. Taylor. It is a fact that when the weather is fine, many upper classmen go for a brief walk between the inspection at 6:20 and assembly for breakfast at 6:30. But not the case with Mr. Ducrot. When the first call for breakfast goes at 6:25 he runs to his place in ranks and stands there "At ease." Before assembly he is inspected by one of the cadet officers or non-commissioned officers of his company ("Makes" cadet slang calls them) to see that his shoes are properly shined, that he is clean shaven, his uniform is brushed and spotless, and that he has clean collar and cuffs in his dress coat. Upper-classmen are not inspected at this time, but a flagrant violation would be noticed and result in a caution, and if that were unheeded, a report which would carry punishment with it. Usually the habits formed in the plebe year last through and a good personal appearance becomes a matter of pride with a cadet. Those who fail to get that point of view have it further impressed upon them by punishment.



Cadets at Coast Artillery Training

After graduation the new first class is taken to Fort Wright, Fishers Island, New York, and is given two weeks instruction in handling and firing heavy seacoast armament

Mr. Ducrot returns from breakfast at about 7:10 and has from then until 7:55 to study, or, if room orderly, to complete dusting and preparing his room for inspection. Usually roommates have an agreement as to the dusting which each will do and each does it every day, so that the sweeping is the only thing which the room orderly does extra, except that he is responsible for the condition of the room. Scrubbing of the floors and window washing is done by civilian janitors.

The rest of the morning is consumed with recitations, study periods, and gymnasium. In the upper classes riding replaces the gymnastic work. Dinner is at 12:10 and is over at about 12:50. Afternoon recitations, study periods, and riding begin at 1:00 P. M., and last until 3:00. From 3:15 to 4:15 is devoted to drill or intramural athleties during fall and spring, and then four companies attend parade from 4:35 until about 5:10. From then until 6:20 the cadet has free unless he is going on guard, taking extra instruction or serving punishment. During the winter time intramural athleties and parades are discontinued so the cadet gets considerable more leisure then.

Supper formation is at 6:20 and is over at about 7:00. Assembly for Evening Call to Quarters is at 7:15, and from then until Taps at 10:00 he has for study. He is not permitted to make down his bed until tattoo at 9:30, nor is he permitted to visit other cadet rooms. Cadet sentinels are posted on the first floor of the hall of each division of barracks to see that no one enters or leaves the division without authority and that quiet is preserved. At Assembly for Call to Quarters, again at 8:30 and again at Tattoo, the sentinels inspect to see that the occupants are in their rooms.

The company tactical officers inspect every room in the barracks of their respective companies at least once every morning, and at this inspection everything has to be in exactly its proper place, floor clean, woodwork dusted, washstand spotless, shoes dusted and accurately aligned under bed, etc. Anything wrong means a "skin" (report) and punishment. Again in the evening a tactical officer inspects each room to see that the beds are not made down before Tattoo and that the room is in a reasonably neat and orderly condition.

Methods of Punishment of Cadets

Frequent mention has been made to punishment for delinquencies. It is not really as bad as it sounds. There are a very great many offenses for which a cadet may be reported and punished, but by very habit a cadet so orders his life that he avoids a large majority of them, and with few exceptions cadets are free from punishment a large portion of the time. Some few find it very difficult and are in trouble most of the time, and a very small number get punished so frequently that it results in exceeding the authorized number of demerits with subsequnt discharge for deficiency in conduct.

The actual direct punishments are of two kinds—confinements, and punishment tours. Confinement means staying in one's room during the time when one would ordinarily be at liberty. One confinement is served in an ordinary week day, three on Saturday and two on Sunday. A punishment tour means an hour of walking up and down a prescribed beat in the area of barracks. These are served on Wednesday and Saturday afternoons, after recitations on Wednesday, and after Inspection and Review on Saturday, there being no drills on either of these afternoons.

An indirect punishment consists in the awarding of de-

merits. Minor offenses such as a "late in falling in at breakfast formation," "dust on mantelpiece at inspection," etc., would get demerits but no other punishment. In fact, sometimes these are a source of amusement when a tactical officer gets careless in the way he words a report, and the published list contains such reports as "Sleeping between one sheet" or "Empty clothes bag full of old newspapers."

More serious offenses, however, such as an intentional absence at a formation, talking in ranks, inattention at drill, visiting during call to quarters, or some such "skin" as that, would result in confinements or tours or both, depending upon the seriousness of the offense, and, in any case, demerits also. An excess over a certain number of demerits in the course of a month means the deprivation of certain privileges the next month, and a total excess over the period from June 1-November 30 means loss of Christmas Leave, and so on. Then, more seriously, comes discharge for deficiency in conduct if awarded too many demerits.

The delinquencies are published in a list and the cadet reported has the right to go to his company tactical officer to explain his offense. If he has a good excuse the report may be removed. Otherwise the company tactical officer, up to a certain limit, awards the punishment. There is a published list of all offenses which a cadet is likely to commit with respective punishments to be awarded. This is a guide for the tactical officer so that the awarding of punishments in the different companies will be as uniform as possible. In some cases a cadet is required to make an explanation of his offense. For example, an absence has to be explained as to whether it was intentional or not. In cases of doubt in the mind of the tactical officer, or where the offense is such that the punishment would be beyond the limit the company tactical officer is authorized to give, the case would be judged by the "Battalion Board," made up of the three majors commanding, or rather supervising, the cadet battalions. The company tactical officers are captains normally, although at present several are majors. This work is very important because much character forming can be done by the company tactical officer, and able officers of judgment and experience are required.

Class Formation

Cadets march everywhere for instruction and drill in small numbers, at military cadence, and in silence. There is no loss of time and no confusion. Routes are established to prevent interference. The senior cadet in each section is responsible for order and command

Offenses such as drinking or having intoxicating liquor in possession, intentional violation of "All Right," cheating, lying, hazing, or anything of that kind, would be tried by General Court Martial, and guilt would mean instant dismissal.

Relations Between Plebes and Upper-classmen

Hand in hand with the official discipline to which a cadet is subjected, there is the unofficial, but sanctioned by custom, discipline. In fact, much that was good in the old-fashioned hazing is now a matter of official regulation, so that the evils of hazing may be more easily kept out. Hazing, as such, has practically disappeared at West Point. Occasionally a case will crop up, but it is not at all general, and when it does occur the subject is almost always a plebe who for some reason or another is not willing to conform to the age-long customs of the institution, and

such a man's life is made really miserable, even by his own classmates. These customs serve to make a man of the plebe and a few of them will be cited.

In the first place, a plebe is taught to recognize that in the military service a senior is entitled to respect, and that as cadets, upper-classmen are their superiors. In fact, the same thing applies to the relations between yearlings and 2nd or 1st Classmen, but not in such a marked degree. Upper-classmen have the right to advise and correct a plebe provided the spirit is not to humiliate or demean.

One thing that marks very distinctly the difference between the manner in which first year men are treated at colleges and at West Point is that at the Military Academy the fundamental purpose behind the treatment given is to improve the man getting it and not for the amusement of the man giving it. Of course, there is some horseplay, but if a plebe asks a question of an upper-classman to really get information, the upper-classman is by custom bound to give a correct answer, or tell him where he can find out the answer, never to tell him something wrong which may make him do something ridiculous, which is so often the case at college.

Plebes do not go to the cadet dances, or "hops" as they are called, and in many other ways are shown that they must prove themselves for a year before they can enjoy social equality with the rest of the Corps. An upper-classman who has previously known a plebe will "recognize" him by shaking hands with him, and from then on between those two no barrier exists. This is also the case between upper-classmen and plebes on the same Corps athletic squads. Usually, upper-classmen will recognize plebes from their own state and will be very helpful to them with counsel and advice.

Physical violence even in fun is not tolerated but is construed as hazing. Plebes are not molested at night or at any time when it would interfere with proper performance of their work. As previously stated, in the Mess Hall they are required to recite poetry or something like that, or learn various facts about the history of West Point or of the Army. But in general the attitude is that they are practically ignored except for correction if they show need of it. At the expiration of their year, usually at the breaking of ranks after Graduation Parade, there is a general handshaking and as a class they are "recognized." Of course, long before the year is over, constant contact in barracks, ranks and mess hall has caused many real friendships to be formed underneath, so that the "Glad to know you" that goes with the handshake is really heartfelt. Many times a plebe will find that an upper-classman who has "ridden" him hardest really has a strong liking for him and has his best interest at heart.

The Moral Upbuilding of a Cadet

The fall schedule finds many changes. Mr. Duerot is assigned to "B" Company and fortunately the classmate whom he likes best is also in the same company and they have the opportunity to choose each other as roommates together with another man they both like.

One of the first new experiences is Chapel, which all Cadets are required to attend. During the summer the plebes attend divine service with the rest of the Corps. This service was formerly held early each Sunday morning in the open air at Battle Monument, and whereas the service was very good the plebe had too many other things occupying his attention to have the service as such make much impression upon him. But now the service is held in the very sacred interior of one of the most beautiful chapels in the world. The organ is one of the largest and best, and even the most hardened materialist cannot fail to get a thrill of inspiration to hear this body of men, led by the Cadet Choir of 135 voices, singing "Alma Mater" or "The Corps." The singing of one of these songs usually forms part of the service. The service follows the Prayer Book of the Episcopal Church but uses only those portions which are practically common to all Protestant denominations, so that the service is really one which men of all creeds of the Protestant Churches may enjoy. Any professed Christian may take Communion. The Chaplain is an exceptionally fine man for the position, who, in addition to being a fine preacher and religious worker of deep faith, is a *man* whom all the cadets admire. They have free access to him as a counselor in every-day matters and he welcomes their confidences. Incidentally, he is one of the best tennis and golf players at the Academy and is coach of the Corps tennis team.

Those of the Roman Catholic faith are equally fortunate in having a very beautiful chapel, which, although smaller, is admirably designed for its needs. Although located on the reservation, it comes under the jurisdiction of the pastorate in Highland Falls, a nearby town.

There is a Y. M. C. A. organized in the Corps which is quite active and has meetings with capable speakers on Sunday evenings. It prepares and issues the "Plebe Bible," previously referred to, which is a compilation of information and advice for a plebe.

The question of moral welfare cannot be left without speaking of the Honor System at West Point. Corps Honor is something that has been handed down from the very foundation of the Academy, and is always spoken of seriously and held sacred. There is an Honor Committee of thirteen first classmen who work together with the Tactical Department to see that honor is maintained at the very highest. All cases of breach of honor are investigated and settled by this committee. Such cases are very rare and usually are unintentional and through ignorance. If not done purposely, the offender is not dismissed but is cautioned and severely punished for his carelessness. There are many times that a cadet reports "All Right," which in general means that whatever the cadet is doing is authorized. For example, when crossing a sentinel's post with proper authority, the cadet reports "All Right, Sir," which means on his honor that he *has* the authority. No sentinel would think of questioning his report because no worthy cadet would think of so reporting unless it *was* all right. An intentional violation means instant dismissal. The most common work of the Honor Committee is in making interpretations of the various meanings of "All Right" and similar matters, and seeing that such decisions are published to, and thoroughly understood by, the Corps.

Cheating in the class room or the intentional rendition of a false report by a "Make" to shield the absence of a friend, would mean either dismissal by sentence of Court Martial or a peremptory order from the Honor Committee to resign. In other words, a cadet is taught from the very beginning that his word is his bond, and no equivocation or quibbling is in accord with the standards of a cadet and gentleman.

About the middle of January comes "Foundation Day," when those who have failed in some academic subject are notified that they are discharged. The plebe class suffers by far the most casualties, this being their first weeding out. There may be as many as 20 per cent "found de-

ficient." Some may be in only one subject and will be given the privilege of taking a re-examination the next summer and starting over again. But others are through permanently. After six months of close association Mr. Ducrot has grown very fond of some of these men and will miss them. Some upper classmen will be "found," too, and altogether it is a day of sad partings. Men are found also at the end of the spring term so that before a class graduates it is not unusual to have had as many as one-third fall by the wayside, unable to stand the pace of the academic work.

But West Point is a typical case of the survival of the fittest and a cadet must pass in everything. It is best for him personally and for the government, that, if he cannot make the grade, he stop trying as soon as it can be determined, so that he no longer wastes his own time or the tax payer's money.

Recognition and What It Means

The Navy basketball game, the intercollegiate fencing meet, and Memorial Day make landmarks in a swift spring's progress and now June has arrived. June,—the most wonderful month of the year to all cadets. To the plebe it means "recognition" and the crowning of a year of trial. He will be suddenly transformed from the low ranking status of a plebe to the highly elevated standing of a "yearling," or 3rd Classman.

The June week exercises, exhibition drills, etc., are soon over and then Graduation Parade. How Mr. Ducrot does brace them! But inside he is smiling because he knows that when he gets back to the area, and his company is dismissed, the very men who are bracing him hardest will be the first to grasp his hand and say the few words, "Glad to know you, old man, you've been a good plebe." Very likely the tears will come to his eyes as he realizes that he has stood the gaff and been found worthy. He knows that the hardest part of his discipline is over and that the rest of his time as a cadet will be spent in fixing firmly the traits he has learned, and to help teach others the same traits.

Recreation of Cadets

And now Jones (no longer *Mr. Ducrot*) finds things different. He has his own name again and he has proved his right to it by his year of trial. Some have made their names more glorious by prowess on the athletic field, by excelling in academic work, or in some other way, but each and every man who finishes his plebe year can be proud and feel that he is really and truly a West Pointer.

The new yearling at first feels rather strange with his new-found privileges and rank, particularly as for the first two weeks he has no senior cadets with him. The erstwhile yearlings have become 2nd Classmen and have gone on the long-looked-forward-to furlough. The new 1st Classmen have gone for a week's practical instruction in coast artillery, at Fort H. G. Wright, on Fishers Island, in Long Island Sound, and for another week with the Air Service at Mitchell Field, Long Island. These two weeks are devoted by the yearling to small arms target practice. He is busy but he finds time to enjoy pleasures which have been previously denied him. Possibly his old sweetheart from the home town has come with her mother to stay a while at the West Point Hotel. Afternoon walks around Flatiron Walk and dances three times a week are new sensations. On the evenings when there are no dances there are band concerts and on Sunday evenings the Color Line Concerts previously mentioned.

There are other ways in which cadets get recreation. There is an excellent library for those who are inclined to read as a pastime. Then there are horseback riding privileges for the two upper classes and long walks in the beautiful hills back of West Point which even plebes may enjoy. Those who desire may play golf or tennis.

The Camp Illumination, previously mentioned, comes at the end of summer and the only other organized amusement is what is called the "100th Night Show." This takes place in February in celebration of the fact that only one hundred days remain until June. It is handled by what is known as the Dialectic Society to which all Cadets belong. It is usually a farce, poking fun at some feature of life at West Point, and, within limits, at the tactical officers and instructors. The music is original and sometimes very good. To a seasoned theatre-goer it would be terrible, but the cadets hail it as quite an event.

Practical Military Work

But all is not play even in that most irresponsible time of Yearling Camp. There is plenty of guard duty to perform so that Jones knows very well just what it means to be a sentinel on post, and in his first class camp will learn the duties of the officers and non-commissioned officers of the guard. The 1st of July the First Classmen get back and work begins in earnest. Summer is devoted to practical military training and the schedule is a strenuous one. There are three periods of this work of about twelve working days each. The first nine days are preparatory and the last three days are devoted to maneuver problems. The cadets are divided into three groups, and during the first period one group is instructed in artillery and cavalry, the second group in infantry weapons, and the third group in infantry combat work. The groups shift at the end of each period.

During the three-day maneuver problem, targets are placed in position and real service ammunition is used. After each step in the problem a critique is held and just what is being done is explained. At the end of the second nine-day preparatory period the same problem is repeated, but the men who were artillerymen are now infantrymen, and so on. At the end of the third period each cadet has seen the problem worked out three times, participating once as artillery or cavalry, once as infantry, and once with the infantry special weapons. This gives him a very good idea of the co-ordination between the different branches. He also has opportunity to see the signal corps handle communications and pyrotechnics, the engineers at work, and an Ordnance maintenance company in operation. He also gets practical experience in sleeping in a shelter tent and eating from a rolling kitchen.

How practical this summer training is may be judged by the fact that over one hundred tons of ammunition are expended. The Ordnance Department representatives at the post are kept on the jump all summer in order to give proper service of supply and maintenance.

First Class Winter

This one is different from the others in several respects. As a 1st Classman he has more duties and responsibilities, and more privileges. He now has his First Class

Club where during free hours he can play billiards or otherwise relax. He is looked up to and respected by under-classmen. The responsibility of keeping up the customs of the Corps rests upon his shoulders. The influence of 1st Classmen in forming Corps character is a heritage handed from one class to another which must be received with a full sense of responsibility.

His tactical instruction also shows that he is nearing the end of his course. In addition to a continuation of infantry drill and intramural athletics during the fall and spring, and some field engineering, he gets professional lectures on army customs, etc. He gets more advanced tactics; he is taught to teach calisthenics; he gets instruction in the making of field fortifications, and a brief practical course in mechanical trades. At intramural athletics, if he has shown any aptitude in a particular sport, he may be an assistant instructor.

In the spring he also gets a trip of inspection to an Ordnance establishment as part of his instruction in Ordnance.

The Product

The day before Graduation the band plays the old traditional tune, "The Dashing White Sergeant" at parade, and when normally the battalion commander goes front and center, the entire 1st Class falls in line with the staff. The remaining members of the Corps then pass in review before them and gladly execute "Eyes Right" as a parting tribute to those who have finished and are about to leave.

On graduation morning a diploma, the highest honor the Academy can bestow, is handed to Jones. It certifies merely that he has satisfactorily pursued the four years course of study. But a larger meaning has been accorded this certificate because of the records of those who have passed his way before for nearly a century and a quarter. It is that Jones has formed his ideals of life in the loyal and patriotic atmosphere of West Point; that he has educated his mind to meet the responsibilities of peace and the emergencies of the battlefield in whatever rank or duty the Army may find for him; and he has trained his body to carry him where his service may be most effective for his country. He may not become the leader of the armies of the nation, he may be surpassed by others who have not the diploma of West Point. However, he has acquired the *spirit of service*, and we may confidently expect that in whatever field of duty he may be assigned he will give his all and do his best. He will perform his duty with honor to himself and loyalty to his country, with, as all others before him, a heart full of reverence for a beloved Alma Mater, West Point!

THE CORPS

The Corps! bareheaded, salute it,
With eyes up, thanking our God—
That we of the Corps are treading
Where they of the Corps have trod.
They are here in ghostly assemblage,
The men of the Corps long dead,
And our hearts are standing attention
While we wait for their passing tread.

We sons of to-day, we salute you,
You, sons of an earlier day,
We follow, close order, behind you,
Where you have pointed the way;
The long gray line of us stretches
Through the years of a century told,
And the last man feels to his marrow
The grip of your far off hold.

Grip hands with us now though we see not,
Grip hands with us, strengthen our hearts,
As the long line stiffens and straightens
With the thrill that your presence imparts.
Grip hands, tho' it be from the shadows,
While we swear, as you did of yore,
Or living, or dying to honor
The Corps, and the Corps, and the Corps.

—*Rev. Herbert Shipman,*
Chaplain U. S. M. A., 1896-1905.

Ordnance and Gunnery at West Point

By

B. ST. G. TUCKER

THE course in Ordnance and Gunnery at the U. S. Military Academy extends throughout the first class year (fourth academic year). During the first term the course includes a study of the properties, manufacture, care and use of explosives, the theory of explosives, measurements of velocities and pressures, interior ballistics, exterior ballistics, projectiles, bombs, pyrotechnics, primers, fuzes, ammunition supply, probability of fire and adjustment of fire.

During the second term the course includes the study of the historical development of arms, materials used in construction of arms, principles of design of guns, carriages and recoil systems, small arms, machine guns, artillery (field, seacoast, railway and special), automotive equipment, tanks, tractors, trailers, and fire control equipment.

Recitation in Exterior Ballistics, Department of Ordnance and Gunnery, U. S. M. A.

The course is supplemented by lectures, and by exhibits and models of the various types of arms, ammunition and accessories.

Practical instruction is given in mechanical trades and is devoted to the principal operations performed in the ordinary wood and metal working shops. This includes the use of hand and machine wood-working tools, also bench and vise work, turning, planing, shaping, drilling and milling operations, and the forging and hardening processes of metal working shops. The practical instruction is supplemented by lectures, and demonstrations on the maintenance, repair and operation of Ordnance material in the field.

In detail the course covers the following:

Course I. (First Term)

The munitions problem.—The outline of the organization by which the munitions of war are produced and the place of arms and ammunition in this program.

Explosives and their characteristics.—A study of the history of explosives up to the development of smokeless powder and the nitrated coal tar products; an analysis of what is required of explosives for various purposes, and the reasons for using explosives of certain characteristics in military problems.

Determination of explosive power.—Fundamental discussion of the heats of formation of various substances and the decomposition of various substances into gases and solids of different characters. The expansion of gas by such decompositions under the calculated heat released by the reactions.

The use of explosives in a firearm.—The determination of the force of expansion in a closed chamber. The amount of pressure developed under given conditions and a determination of the energy given to a projectile.

The charge of a firearm.—A description of the manner in which the charge of a firearm is built up for all types of firearms. The manner of ignition of the charge and its inflammation in the powder chamber.

The burning of the charge in the bore.—Evaluation of the power developed, and the pressure produced by the decomposition of the powder grains.

The action of gases in the bore.—A study of LeDuc's formulas for interior ballistics, with developments for various conditions that may exist and the determination of the pressure and velocity obtained from powder charges of standard form.

Effect of variations in the charge and projectile.—A discussion of the effect of variations from standard conditions upon interior velocities and pressures.

Materials used in producing explosives.—A study of the sources of nitrogen and the analysis of the fixation of atmospheric nitrogen and a study of the several processes. A discussion of coal tar products, sulphuric acid, cellulose, alcohols, and other essential ingredients and their connection with particular explosives required for the military purposes.

Manufacture of propellants.—A study of the manufacture of black powder and of smokeless powder.

The manufacture of disruptives.—A study of the several types of explosives which are in use in the military service for demolition, for the bursting of various types of projectiles, bombs, grenades, mines and other military ammunition.

Projectiles for firearms.—A study of the projectiles used in the United States service, with special reference to the functions of the different parts of the projectile in attaining range or in destroying the target.

Projectile accessories.—A study of fuzes, boosters, adapters, shell fillers, closing plugs, base covers and other component parts of the service projectile.

Small arms and field artillery ammunition.—A description of the assembly of ammunition into various types for use in small arms and field artillery, with a discussion of the functions of the several types for particular phases of firing.

Seacoast, railway, antiaircraft and trench warfare ammunition.—A description of the kinds of ammunition used in the different types.

Bombs and pyrotechnics.—A discussion of the development of bombs and the purpose for which they are used; a discussion of the production of pyrotechnics for particular uses in warfare with a description of the several types.

Ammunition supply.—A study of ammunition supply in time of war, starting with the manufacturing plants, through the various reserve and intermediate ammunition Depots, up to its delivery at the firing line. The care of ammunition en route, in addition to the salvage of ammunition.

Measurement of velocities.—A study of the special instruments used to obtain the velocity of a projectile through the air.

Measurements of pressure and temperatures.—A study of the instruments used to obtain pressures and temperatures encountered in service firing.

The energy of the projectile in the air.—A study of the retardation of a projectile under the influences of gravity, air density, wind and wave motion.

The path of a projectile.—Determination of the trajectory *in vacuo* and a description of the terms used in referring to the elements of the path of a projectile.

The integration of the path of a projectile.—A mathematical discussion of the path of a projectile, with special reference to the assumption made in direct integration.

Numerical integration of the trajectory.—A study of the accurate development of a trajectory by simple numerical integration.

Range tables.—A discussion of the features of range tables and a discussion of their application to firing problems.

Probability of firing.—An analysis of probability and its application to firing problems.

Adjustment of fire.—A study of fire adjustment, and the various methods used.

Course II. (Second Term)

Historical development of arms.— An outline of the development of arms up to the several classifications used in modern military services, including a short history of gun making, leading up to the development of the modern cannon.

Materials used in the construction of arms.—A general description of the several materials and their particular application in the production of the different types of arms, ammunition and accessories.

Steel and iron.—A discussion of the chemical analysis of steel and iron and effect of the heat treatment to produce desirable physical qualities for the manufacture of firearms and special equipment required in military service.

Steel forgings.—A description of the production of steel forgings and the heat treatment of same.

The elastic strength of firearms.—A study of the stresses and strains to which the different members of a firearm are subjected under the stresses produced by the explosion of powder in the firearm.

Construction of modern guns. —A description of the building up of modern cannon in accordance with principles previously determined.

Breech mechanisms for firearms.—A description of the several types of closing devices used in the military service for sustaining gas pressure in the breech of the firearm.

The recoil of firearms.—An analysis of the forces developed in the recoil of firearms upon their carriages.

Recoil system.—A description of the various devices used to check the recoil of firearms.

Seacoast artillery recoil.—A detailed description of the methods of checking recoil in fixed mounts used in seacoast fortifications.

Field artillery recoil.—A description of the application of the various recoil devices for checking the forces of recoil in field artillery firearms.

Small arms.—A description of the small arms weapons used by the United States Army.

Machine arms.—A description of the several types of machine guns and automatic rifles used in the United States service.

Field artillery matériel.—A study of the standard types of field artillery in use in the United States service, and a description of the new types which are being developed.

Seacoast artillery matériel.—A study of the development of modern seacoast artillery matériel and of the standard matériel now in the seacoast fortifications.

Railway artillery.—A discussion of the development of railway artillery during the World War; the function of this artillery and the types which have been developed since the World War.

Special artillery.—A description of modern pack artillery, infantry accompanying guns, trench mortars, antiaircraft artillery and tank artillery.

Automotive equipment.—A discussion of the types of artillery vehicles furnished for the transportation of artillery material and ammunition, with special attention to the development of self-propelled mounts.

Tanks and tank equipment.—A discussion of the development of tanks, their construction, their armament, and a description of the new tanks which are being developed.

Tractors and trailers.—A description of the types of artillery tractors in use in the United States service; the caterpiller trailers used in connection with the tractors; the special hand carts and ammunition carts, and the new types of automotive equipment.

Fire control equipment.—A description of various types of fire control instruments.

Aiming and laying devices.—A description of the sights, quadrants, angle of site devices, tracking devices, and other special apparatus by which corrected firing data is applied to service cannon.

Antiaircraft fire control.—A description of the methods of obtaining fire control data for antiaircraft firing and the application of this data to antiaircraft firearms.

The descriptive matter of the course is supplemented in the section room by a very large and complete set of exhibits and models of the various types of arms, ammunition, and accessories, in use in our service. The exhibits and models cover, in general, a wide range of Ordnance material ranging from sectionalized exhibits or models of small arms ammunition, through small arms, machine guns, pyrotechnics, bombs, trench warfare material, explosives, artillery ammunition up to include the various types of field, railway, seacoast and special artillery.

The entire course is laid down to give the members of the graduating class a broad general conception of the design, manufacture, operation and maintenance of the Ordnance material and equipment issued for service. This instruction is elementary, fundamental and general because the time allotted for the course is only 93 hours of recitation work per cadet per academic year, and obviously, the course can cover in an elementary and fundamental way only, the many basic general and technical subjects comprised in the term Ordnance.

In addition to the course as described above, several lectures are given throughout the academic year on subjects having a direct bearing on the study of Ordnance. During the past year, the following lectures were delivered:

1. U. S. Nitrate Plant No. 1, by Maj. J. K. Clement, Ord. Dept., U. S. A.;

2. Future Developments of Automatic Arms, by Major Earl McFarland, Ord. Dept., U. S. A.;

3. Future Designs of Mobile Artillery, by Major L. B. Moody, Ord. Dept., U. S. A.;

4. New Developments in Fire Control Instruments, by Dr. I. C. Gardner, U. S. Bureau of Standards;

5. Munitions Organization, Industrial Organizations, Ammunition Supply in Time of War, and Mechanical Trades, by Major C. G. Mettler, Ord. Dept., U. S. A., Prof. of Ordnance and Gunnery, U. S. M. A.

Practical instruction in mechanical trades is also given as part of the course in ordnance and gunnery.

At the end of the course, usually during the latter part of May each year, the entire first class of cadets is taken on a demonstration trip to one or more of the manufacturing Arsenals of the Ordnance Department. In 1922, Watervliet, Watertown, and Springfield Arsenals were visited where ample opportunities were afforded the cadets to see the various types of ordnance in the processes of manufacture on a production basis. In 1923 the first class was taken to Aberdeen Proving Ground where two days were spent in observing a very complete program of demonstrations and exhibits covering the experimental and research work at the Proving Ground.

The present first class at the Military Academy consists of 406 cadets, and for purposes of instruction in Ordnance and Gunnery, is divided into 24 sections, averaging about 17 cadets per section. Hours of attendance for recitations are from 7:55 a. m. to 9:10 a. m. and from 10:40 a. m. to 11:55 a. m., half of the class attending daily, throughout the academic year.

The text used in the course is Tschappat's *Ordnance and Gunnery*, which is supplemented by a book on Ammunition, issued by the Department of Ordnance and Gunnery. In addition, mimeograph pamphlets on arms and accessories are issued covering the history, development, and characteristics of arms. The basic and fundamental principles of the various subjects of Ordnance and Gunnery are studied from the text by Tschappat, and the supplementary matter has brought the various subjects up to date, as far as new principles, new designs and new processes of manufacture are concerned.

Perhaps the most difficult part of the Military Academy instruction is the attempt to teach engineering application without proper laboratories or properly equipped lecture and section rooms. There is at the present time no properly equipped engineering laboratory at the Military Academy and there are no lecture rooms assigned exclusively for Ordnance engineering demonstrations. Such equipment as is available is taken from the store room, to and from the section rooms, throughout the entire course.

During the first year the cadet should study the application of the principles of engineering to the tools of his profession and a properly appointed building should be provided, wherein the civil, mechanical, electrical and chemical phases of engineering could be presented, where lecture rooms and section rooms would be available and properly equipped, and wherein the necessary machinery and equipment could be displayed and utilized to properly present the value of the study of engineering, in all its phases, in connection with the design, production and maintenance of Ordnance.

ALMA MATER

Hail, Alma Mater dear,
To us be ever near,
Help us thy motto bear
  Through all the years.
Let duty be well performed,
Honor be e'er untarned,
Country be ever armed,
  West Point, by thee.

Guide us, thy sons, aright,
Teach us by day, by night,
To keep thine honor bright,
  For thee to fight.
When we depart from thee,
Serving on land or sea,
May we still loyal be,
  West Point, to thee.

And when our work is done,
Our course on earth is run,
May it be said, "Well, done;
  Be thou at peace."
E'er may that line of gray
Increase from day to day,
Live, serve, and die, we pray,
  West Point, for thee.

The 29th Ordnance Company at West Point

By

R. N. BODINE

WHEN the Continentals occupied Constitution Island in 1777, they built a munitions storehouse and appointed an armorer and Ordnance man to look after the powder and arms. In 1778, when they crossed over to West Point, magazines were built in Forts Clinton and Putnam and the caretakers, powdermakers, gunsmiths, and armorers were assigned to the care of arms and ammunition. Since those days there has always existed an organization to look after the ordnance supplies of the garrison and to further, directly and indirectly, the instruction of the cadets of the Military Academy. The 29th Ordnance Company is the direct successor of the former organizations and has taken over their duties along with the new ones it has acquired.

The 29th Ordnance Company at West Point

A group of mechanics, storekeepers, armorers, smiths, carpenters, welders, chauffeurs, cooks and clerks who take great pride in teaching, supplying and maintaining ordnance for the Corps of Cadets

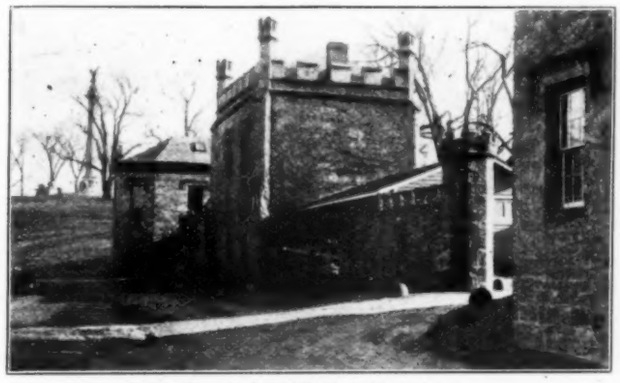
In 1920, the Ordnance Department gathered together the various detachments of its troops into maintenance and ammunition companies and assigned them to definite tasks and stations. The detachment at West Point, numbering about thirty men, became the 29th Ordnance Company. With the increase of the Corps of Cadets it expanded to a full company strength of forty-eight men. In 1921 the necessary maintenance and company equipment were provided and the enlisted men were instructed in their use and operation, in addition to their usual duties in connection with the instruction of cadets. Three galvanized iron buildings were received from Amatol Arsenal, and these, together with a garage, were erected by the company on the slope below its barracks, thus furnishing storage for the wheeled equipment and a satisfactory place for company instruction.

Former detachments were allotted one building of the Ordnance Laboratory enclosure for its barracks and four non-commissioned officers' quarters on the post for its married enlisted men. The men were attached for rations to a larger detachment on the post, whose quarters were at the foot of a steep hill over an eighth of a mile distant, and were compelled to climb down and up the distance each meal. No funds could be procured for new construction or for any improvement of living conditions. The company has removed partitions, constructed bath rooms, and painted its quarters in the attempt to obtain a more comfortable condition of living. With the help of the Quartermaster, a galvanized iron structure was obtained and erected for an Ordnance property storehouse, vacating a laboratory building similar to the barracks. By company effort, this has been opened as a squad room and recreation room. A former loading building and small storehouse has been refinished as a dining room, with the company office on the second floor. From salvaged lumber and from small purchases made from the appropriation for maintenance of buildings, a presentable and efficient kitchen has been erected by company labor and a mess placed in operation. Even with the daily ration allowance of about thirty-one cents a day, and a very small outside income accruing to the organization, this mess has been providing excellent food. Thus, almost entirely by its own efforts, the Company has bettered its condition from one of discomfort to a certain degree of satisfaction and comfort.

The apparent low wage of the enlisted man does not attract the matured and established artisan, so that in the Ordnance, as well as in the other branches, first enlistments are mostly confined to very young men from farm, village, and city, who enter the service for a variety of reasons—an effort to escape an otherwise colorless existence, the appeal of the uniform, the opportunity

of travel, and, in many cases, the desire to take advantage of the opportunity an enlistment in an Ordnance Maintenance Company offers in learning a trade.

The grades and ratings authorized furnish an incentive and reward for general conduct and efficiency, and for a satisfactory performance of the man's individual duties. Non-commissioned officers are appointed by the Chief of Ordnance, but the assignment of a specialist's rating is entirely within the province of the company commander.



Barracks of the 29th Ordnance Company
These three buildings form the picturesque home of the company. Battle Monument is in the background

The company has two functions: first, that of a regular maintenance company prescribed in War Department instructions, whose responsibility it is to repair and maintain all ordnance equipment of the organization to which it is assigned. For this purpose it is equipped with certain types of trucks on which are mounted machine tools, equipment and necessary supplies, which, with other wheeled equipment, make it a mobile self-contained unit.

The first of these functions will be only touched upon in listing the heavy material in the hands of the detachments of Field Artillery and Coast Artillery, the responsibility for the inspection, maintenance and repair of which attaches to the Ordnance Company at West Point. The material includes: 24 75-mm. guns and carriages; 2 47-mm. guns and carriages; 2 155-mm. howitzers and carriages; 55 caissons, limbers, and similar artillery vehicles; 13 5-ton tractors; 3 3-inch field gun trailers; 1 artillery repair truck; 2 75-mm. antiaircraft guns and mounts; 2 155-mm. guns and carriages; 4 8-inch howitzers and carriages; 2 6-inch disappearing seacoast guns and carriages, and 2 12-inch seacoast mortars and carriages. For this and similar work the complete tool equipment in the permanent machine shop in the Ordnance Laboratory obviates the necessity for the use of the less suitable special mobile organization equipment.

In addition to his academic duties, the Professor of Ordnance and Gunnery is Post Ordnance Officer and is in general charge of all ordnance activities on the post. One technical sergeant as clerk and one private as stenographer and typist handle the necessary academic records, reports, and correspondence.

The property office controls or supervises the accountability and handling of all property of whatever nature or source in the hands of the ordnance company and storehouses and the general surveillance of all ordnance property at West Point. It is usually engaged also in forecasting the probable training work of the Cadets for the next season and preparing requisitions for the supply of the necessary ordnance stores and ammunition.

One sergeant of ordnance and an assistant with storekeeper's rating operate the ordnance issue storehouses and magazines for supplying the cadet armory, the twelve enlisted organizations, the departments of instruction, the target ranges and the large number of individual officers stationed at this place. As the cadets fire pistols, rifles, machine-guns, trench mortars, 37-mm. guns, light and heavy field guns and use all varieties of grenades and fireworks, a complicated ammunition storage problem results. Quantities of explosives are stored for demonstration purposes. One magazine, formerly in the isolated area, has been surrounded by the growth of the post and must be limited to small arms ammunition storage. A second magazine, in the forest, contains explosives and fireworks. A galvanized iron shed is used to house artillery requirements. Estimates have been submitted for new magazines, but a great deal of care is required in supervising and handling the large quantities of ammunition consumed each year in cadet training. The ordnance company unloads, transports and stores all ammunition received at the post.

A considerable quantity of valuable equipment and many important relics are received by the Ordnance Museum. A sergeant and six assistants operate the museum and the museum storehouse. The museum attendants are trained as guides to the thousands of visitors constantly passing through and to the cadets who use it for the study of the development of arms.

For small arms target practice, three ranges are provided. These are under control of the ordnance company.

The Laboratory shop stores and tools are accounted for by one enlisted specialist detailed to that duty. He operates the shop store room, issues supplies and equipment, and provides material for instruction. During mechanical trades instruction, from October to March each year ten to fifteen enlisted men are detailed to the shops as assistant instructors, and are trained there daily by the master mechanic. These men come to take considerable pride in their own machine work and in their instruction. At the end of their enlistments, they are well trained as machine operators. At other periods than cadet training, some men are kept in the shops to assist in maintaining the post armament, in operating the truck machinery for cadet instructions and to overhaul the shop machinery for the next year.

The routine company administration is handled by the first sergeant and company clerk. The first sergeant also operates the company mess, using two cooks for handling, cooking and serving the food. He is also the company supply sergeant, controlling and accounting for the company equipment and supplies to the company commander.

A master sergeant looks after the distribution of the company personnel to the various tasks about the post, and constantly keeps in touch with and coordinates the work in order that cadet instruction may not be delayed or embarrassed at any point. He advises the Company Commander and the Ordnance Officer of present progress and future needs of all divisions of ordnance work.

The Company Commander is now detailed to the task for one year, in addition to his normal duties, as instructor in Ordnance and Gunnery and Mechanical Trades. For a considerable portion of the year, these duties take up most of the day from seven forty-five a. m. until four fifteen p. m. and leave little opportunity to give direct supervision to company work. The allotment of officers to the Military Academy will not permit the assignment of an officer to

(*Continued on page 323*)

Physical Training of Cadets at West Point

By

H. J. KOEHLER

THERE are three sides to the training of any young man for the business of life—the mental, the spiritual and the physical. It is quite as hard to decide which is most important as to designate the principal leg of a three-legged stool. For the military officer, knowledge of the principles of science and the arts is highly important, but without vision this knowledge cannot be applied with efficiency, and without a trained and healthy body to carry the educated head to and around its field of duty, a great limitation is imposed. In fact, many minds are cramped and denied their full expression and attainments by the discomfort and annoyance of a weak body.

Every year on the first day of July, between three and four hundred boys from seventeen to twenty-one years of age pass the final physical examination and are accepted as cadets at West Point. A large percentage of the candidates have already been rejected for physical defects and have returned to their homes.

In unorganized groups they wander in like colts from the pasture, shy, green, awkward, scared but inquisitive. Their supple young bodies have mostly grown by the grace of God to their present shape with little parental care or attention to their proper carriage or health. Their padded clothes cover many hollows and protruding joints. They slouch from the shoulders and bend uncomfortably at the hips. Their heads sit forward or lean backward on the top of their spines. They show up badly in comparison with the erect, grateful, uniformed figures of the cadets who pass among them to guide and direct. For over forty summers I have watched this performance and have had a part in the transformation. I really believe that the American youth is becoming each year a little better physical being. Since the World War, in which so many fathers learned the value of physical fitness, I have noted a marked change for the better.

Lieut. Col. Herman J. Koehler
Master of the Sword
United States Military Academy

The insistent ring of his commanding voice and the compelling gaze of his keen gray eyes have straightened the bent and slouching backs of forty classes at the Military Academy. No other man has made such a visible mark on the military man-power of the nation as he has in his forty years of splendid service

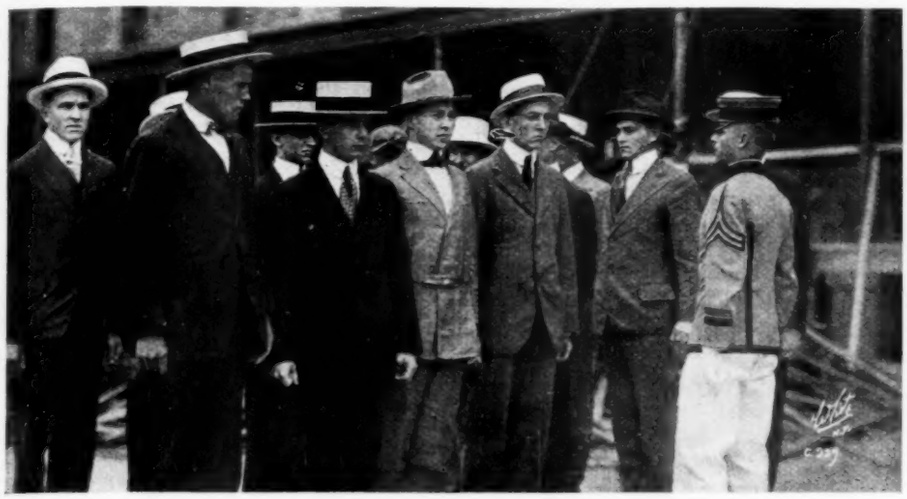
Our first problem is to straighten out the slouch, erect the head, awake the attention and teach the youth the position which he should carry as a cadet. After the early drills every cadet knows that position well. Throughout the first year, he is constantly reminded by the upper classmen of every failure to maintain it either in ranks or around the barracks and camp. His exercises tend to build his muscles around that position to make it the natural carriage of the cadet and the graduate. The erect, uniform appearance of the corps on parade is due largely to the early drills and constant effort to carry this position.

Our next problem is time, unison, cadence; counting, one, two, three, four, at an even rate, two beats per second. To secure the maximum effort from a group of men or machines, they must move simultaneously with one accord. The ignorance of musical time in these days of the phonograph, the radio, the ever-present jazz dance halls and the almost universal popularity of modern dancing, seems quite improbable, yet it is often difficult to secure the exact coordination of feet and hands to the cadence of two beats to the second. On the second of July, the corps marches by from the camp to the mess hall. The beat of its footsteps is sharp, distinct—thud, thud, thud. Behind them from the barracks come the new plebes. Listen! The beat is prolonged, irregular. Some are ahead, some behind, but they are learning that second lesson: cadence, rhythm, time—one, two, three, four.

At the end of the first week the new cadets are clothed in their loose training uniforms—gray trousers, gray shirts, campaign hats. They are marching everywhere in groups at quick, sharp step, heads erect, shoulders back, chins in, stomach held up, buttocks forward, backs straight and arms swinging naturally at the sides. They look a little constrained because the position is still new and an effort must be made to hold it, but they are feeling the pride of marching together better and better. Every group movement for the next four years will be by marching; to the drills, the recitations, the mess and the athletics. It becomes part of the conscience; second nature.

A new routine of life is established. The cadet rises before six o'clock, dresses rapidly and is in ranks to answer

roll call as the hour strikes. A little exercise is given to loosen up his muscles and shake out the sleep. After a half hour of police and personal attention, he is again in ranks going to his breakfast. In the middle of the morning he is out on the drill plain in athletic clothes, taking his physical training. When night comes after the crowded day, he is eager for sleep.



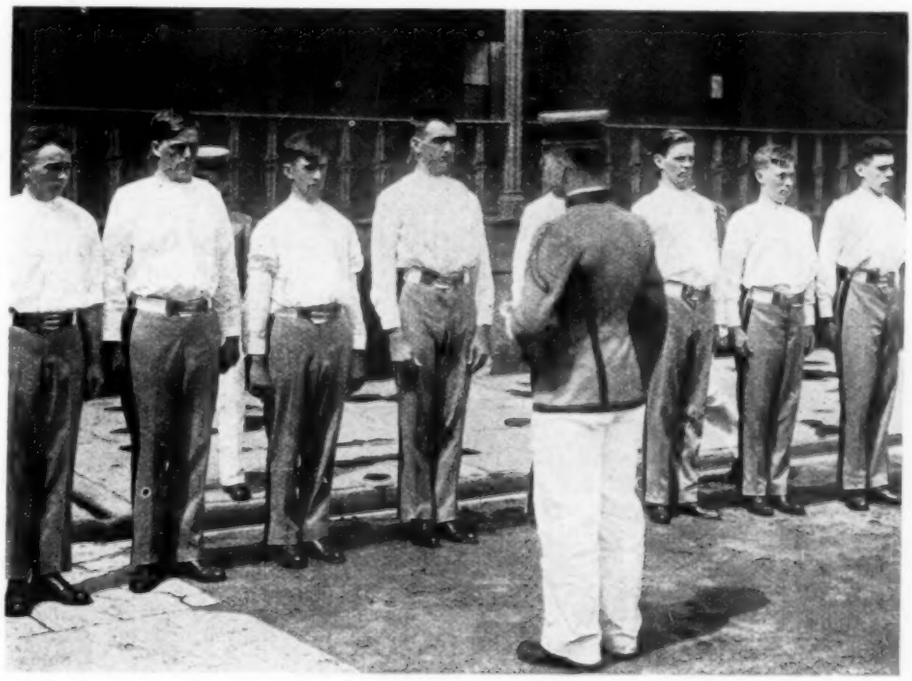
The First Day

The new cadets arrive from every corner of the United States in every style of civilian dress and with all types of physical bearing. They are met by cadets of the First Class and are promptly organized into convenient groups. The experience is so new that there is only the thought of obedience and attention on the part of the new arrivals

His physical training advances as he masters each phase. His muscles become freer, and easier to handle. His movements become quick, but not nervous. His mind becomes alert and keen, but not alarmed or frightened. His voice sometimes scarcely audible at first in the group, becomes louder and better placed under the repetition of commands in unison. He fills out the hollow places, gains in weight, in suppleness and in confidence, just as the raw colt from the pasture arches his neck, fills his haunches and shoulders and becomes the supple trained animal under the careful trainer.

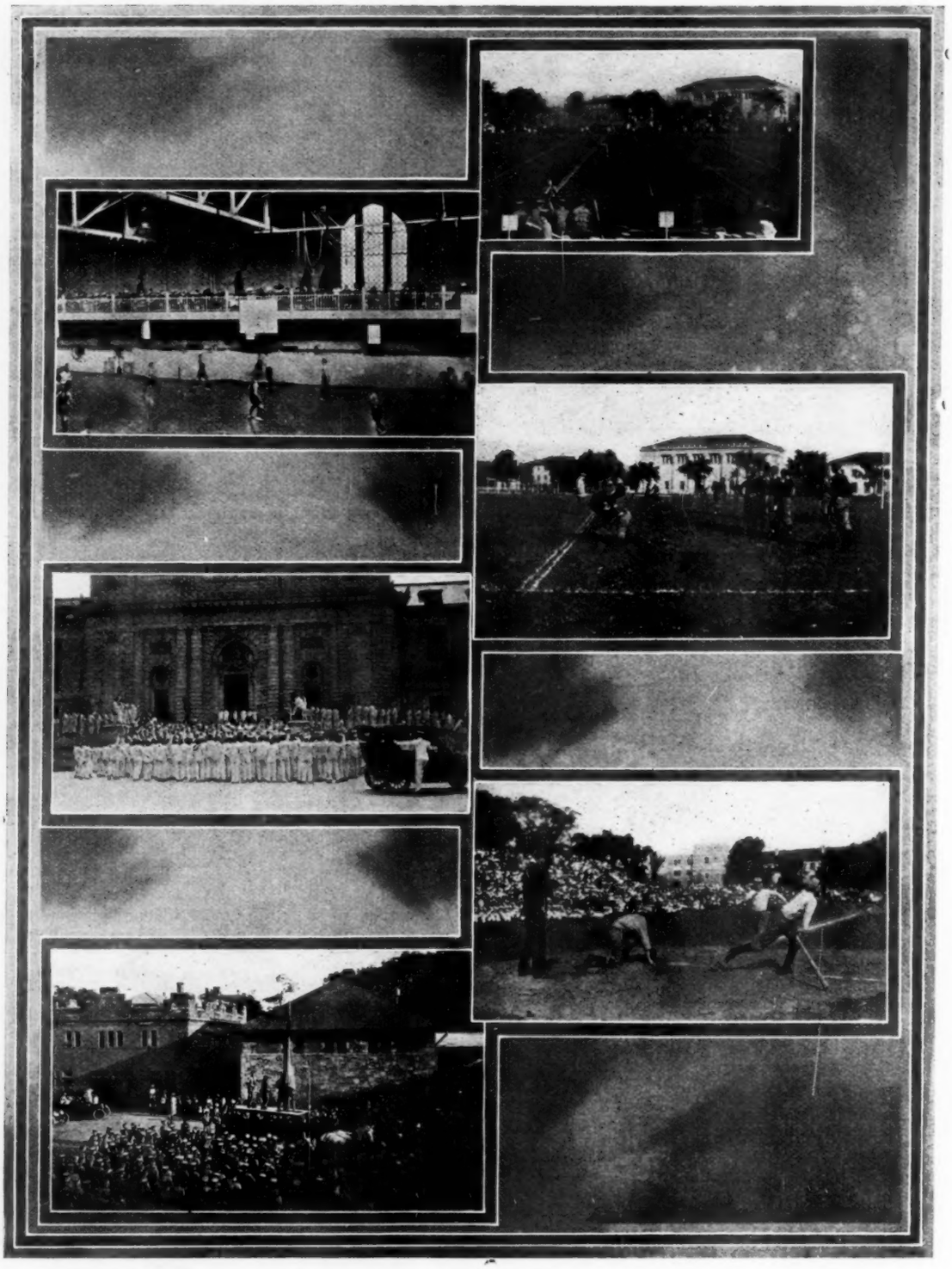
His next lesson is athletics. Drills and exercises become tiresome unless there is something of the game about them. Staleness and dullness of mind come from too long drills, or too many drill days at the same old drill, in succession. The game revives the old interest and awakens ambitions for athletic notice. The class is divided into groups and uniformed, for football, baseball, soccer and lacrosse, and the groups are rotated so that each cadet has a chance at every game. Only the fundamentals are taught, but preparation is made for the intramural training and games of the fall season. The coaches, of course, are anxiously watching from the side lines for new material for the Army teams. The whole summer training is fundamental and separate. At its end, the plebe joins the corps as a full-fledged cadet.

His physical training does not end with the summer, however. Throughout the academic year he attends daily in the gymnasium for an hour, learns new drills, new forms of exercises with machines and implements, new games and new interests. He joins the indoor squads and wrestles, boxes, fences, dances, and swims, until he understands these sports. He plays basketball. Out of doors, he learns tennis, golf, track and the Olympic contests of skill. Perhaps through excellence in any sport, he finds his way to the Army squad and even to the team. This is not required nor requested. He undertakes intercollegiate athletics upon his own initiative, but, once a member of the squad or team, he must be a real athlete to hold his place. There are many contestants for every place. The records of the Army teams speak loudly of the interest in teams and their contests. The inspiration of united academy effort in such contests gathers enthusiasm for the work here and pride in the Alma Mater. They are, however, only a little part of the physical training scheme and touch only that small group which belongs to the squad. The major effort con-



The Second Day

Ready for the first awkward motions which will teach the "Plebes" the value of work in unison and cadence



Athletics

West Point can offer no inducement to star athletes from other schools. They must take the whole routine of academic and athletic drill and must at all times be proficient to remain on a squad or team. But the Academy offers every cadet the full opportunity to develop leadership and physical skill

tinues with each cadet throughout the four years, building for him a sound, supple, clear, manageable body to carry his academic and spiritual training into life with the very best chance of success.

Drills and athletics vary the academic work in the afternoons of the Fall and Spring. These are carried on by companies and great rivalry is manifested. Prizes are awarded the company teams that excel in the outdoor sports to carry on their records to new company members that arrive each year and to spur their interest in athletic and drill perfection. It is a great sight for any eyes that hope to see a great America in the spirit of its youth, to look upon the polo grounds and the plain, to note the intense interest written on twelve hundred radiant faces; to watch their quick decisions, their prompt actions, their accurate performances of their parts in the games, and when the bugle sounds its recall, to see the smiles of health as the company squads march by on their way to the shower baths. There is no dullness, no uneasiness, no resentment. There is the joy of the out of doors; the warmth of physical exertion; the thrill of being a part of a great work. Back in the conscience is the thought, "I can do better tomorrow through the tricks I have learned today."

When the last year's work is over, a cadet should have learned the fundamentals of physical drill, of military exercise and of the principal games which interest and attract our people. Business which was one time done over the saloon bar is now accomplished on the golf links, the tennis courts, or in the grandstand or bleachers of our athletic fields. The officers who train the National Guard and Reserves, must be ready to meet these men at such places with the same interests and enthusiasm. And when men are assembled for drill and exercises, the officers must be able to put into their work the spirit of the game; must hold attention and interest by developing athletics and outdoor entertainment wherein are concealed the mass co-ordination which it is desired to develop.

What does this mean to the munitions engineers, who direct the organizations that produce the fighting tools of armies? It means that those who are coming to them for training, who will carry the work of vital parts of the great war organizations under them, and who will come after them and direct even greater organizations than theirs, can be sent to their first work from West Point with a fine, strong body and a knowledge of how to keep it strong and healthy. They have a physical advantage which should carry them clear-headed into the great work of the future defense of the country. And they have, too, the ability to train men with a happy combination of game, of drill and of joyful, healthy exercise.

The system is not patented. It belongs to every school, training field and organization, which will take the time to examine its work and profit by its plan or its results. If all schools of the country would learn the value of directing the body in its growth as well as the mind and the spirit of the youth, there should be no fear for the future defense of the country nor any doubt of its future greatness among the nations.

The 29th Ordnance Company at West Point

(Continued from page 319)

supervise the company, the maintenance and the ordnance supply although such an assignment is highly desirable.

The company does its full share of routine post duty. Two men daily are furnished for guard duty, frequent details are required for traffic police during the driving season; athletic events require guards and ushers; with the company's interior police and maintenance not to be neglected. The organization is also in sole charge of the care and maintenance of the large number of obsolete guns, carriages and other trophies of historical interest placed about the reservation.

The company is gradually advancing the work with its organization equipment, providing such drill periods as are allowed by its duties at other places. Estimates have been submitted to have a Military Academy detachment of ordnance to take over the work which pertains only to the post routine, leaving the 29th Company ready and able to take the field as a complete unit at any time. But this convenient use of personnel cannot be obtained under the present size of the Army. It is believed that this company on account of its cadet work and its training in maintenance of cadet organizations can be quickly prepared for any assignment in case of any great mobilization.

The present needs of this company are those incident to the formation of any new organization. It has practically no company fund to provide even the usual pool table, phonograph, radio, writing tables and recreation room equipment. The subscriptions of men and officers serve to maintain a good mess but no luxuries. Eventually some means will be found to secure funds and equipment to provide comfort and entertainment outside the squadron. Appropriations are needed to provide steam heat instead of stoves, to provide bathrooms and toilets in the barrack building and to paint and decorate the sleeping quarters and recreation room. A good laboratory building which would properly house the mechanical trades tools would release suitable buildings to house all the maintenance vehicles, part of which cannot now be housed at all and are not kept at this post.

The work of the Company is far removed from the usual routine of ordnance companies and indicates a degree of versatality on the part of enlisted men which is worth while to record and publish. The variety in itself makes the service attractive to many men and gives them opportunities for development which could scarcely be obtained in other places.

It is the desire of the company to enable its men to become better prepared for the problems of the world than they were at their enlistment, and to have them feel that they have contributed some assistance to the nation in that they have helped to teach the cadet who is to be a leader of the nation's armies in the hour of its greatest trial.

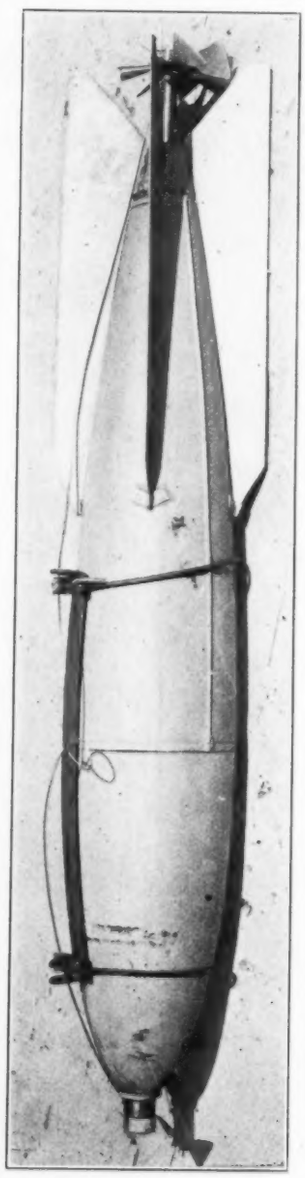
Bombs

PART II

By

WILLIAM A. BORDEN

ARMOR-PIERCING bombs are a special type developed for the attack of targets protected by armor, reinforced concrete or similar covering. Their design requires heavy walls to permit penetration, and therefore the explosive capacity is low. Those developed have followed the general design of projectiles with the addition of fins to guide them in flight, and suitable fuzes to cause them to function. These bombs have a limited application. For use against armored vessels they must actually hit their target to be effective, as their low explosive contents produce little, if any, mining effect. They have a possible use against fortifications where these are protected by armor or heavy reinforced concrete walls. Direct hits also must be made on such targets to obtain maximum destructive effects.



An Intensive Incendiary Bomb

This bomb, which weighs 50 pounds and is 3 feet in length, has a charge of thermit and solid oil. On impact the two fuzes start the ignition of these incendiary materials, which burn for about 15 minutes

The bomb must have a high enough striking velocity to penetrate the armor or other covering which it hits. There being no means yet developed to propel a bomb and increase its velocity, the striking velocity is dependent upon the altitude from which the bomb is dropped, and, of course, to attain a high striking velocity, it must be dropped from a high altitude. Roughly speaking, such a bomb must be dropped from at least 10,000 feet to penetrate 4 to 5 inches of class A or B armor, and must be dropped from higher altitudes to penetrate thicker armor. Beyond 4,000 to 6,000 feet, the higher the altitude the more difficult it becomes to hit a target, and, with the present equipment, considering the relatively small size of the target available for attack with this bomb, it is extremely doubtful if it is of real tactical value. As bombing increases in accuracy, this type of bomb will become relatively more important.

Torpedo Bombs

Torpedo bombs are practically identical with the standard navy torpedo, except that instead of being projected from a torpedo tube on a ship they are dropped from aircraft. In the types so far developed, the standard navy torpedoes are used, being strengthened in certain parts to withstand the forces set up on impact when the torpedo strikes the water.

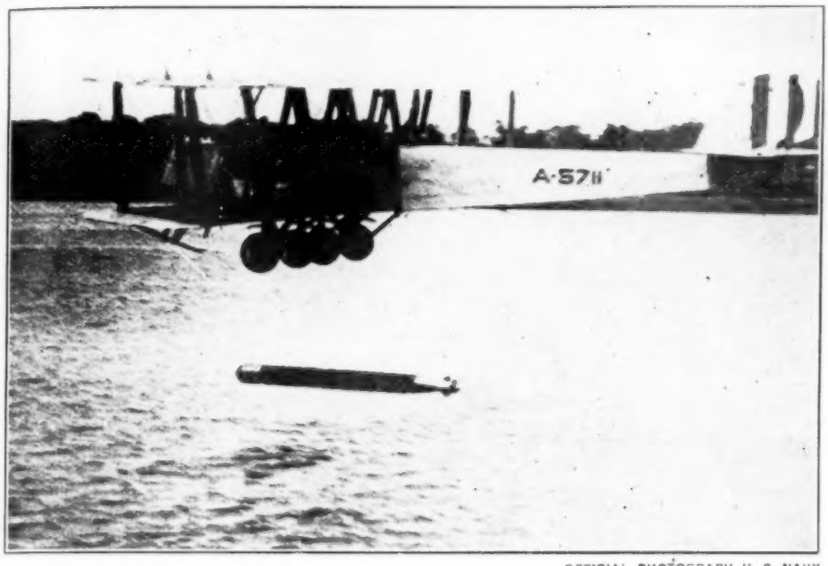
The torpedo is cigar shaped and comprises in its structure a compartment containing high explosive and a detonating train with a suitable fuze to detonate the charge when the torpedo strikes an obstruction. The torpedo is propelled through the water by a driving mechanism included in its structure and directed on its course by a steering and stabilizing device which is also a part of its mechanism.

The airplane carrying the torpedo is headed in the direction in which it is desired that the torpedo should run, and is flown very low over the water. The bomber, using an instrument called a torpedo director, determines the instant at which the torpedo should be released to hit the target. As it falls a starting lever, controlling the propelling and steering mechanisms of the torpedo, is automatically operated by a device attached to the rack. The torpedo, if released properly, falls practically horizontally and strikes the water with the forward velocity imparted to it by the speed of the

An Armor-Piercing Bomb

This is an experimental type constructed by modifying a 12-inch projectile. It has heavy walls and low explosive capacity. It is about 6 feet in length

airplane. It is further propelled to the target, which may be at distances as great as 7,000 yards, by its propelling mechanism. On impact with the target its action is similar to that of the standard torpedo. Torpedoes which have been dropped from aircraft have weighed as much as 1,500 pounds with a high explosive charge of about 300 pounds. The accurate details in regard to these weapons, however, are not available for publication.



OFFICIAL PHOTOGRAPH U. S. NAVY

Dropping Torpedo from Torpedo Plane
The torpedo has just been released from the plane

In trials held with these devices, very successful results have been attained, and without doubt they will find tactical employment in a future attack on naval craft. To hit a target an airplane must approach dangerously close before the torpedo can be released, and therefore for successful attack the airplane must be hidden by a smoke screen properly placed between it and the target, otherwise the attack must be launched at night.

A very special type of bomb, if it may be called such, is the aerial torpedo. As far as is known no such device has been successfully developed, but it is understood that experiments have been held and are no doubt now in progress with a view of obtaining a weapon of this type. The purpose of the aerial torpedo is to give range and direction to an explosive container by employing a carrying device based on airplane or glider design.

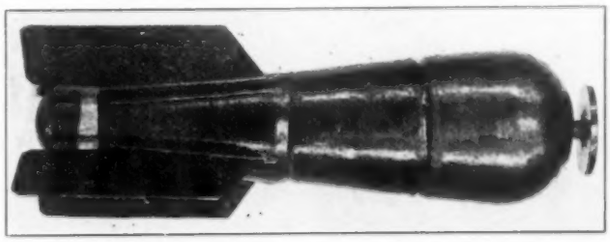
It is believed that one effort resulted in the development of a small airplane controlled by gyroscopes and timing devices which was to be started from the ground, and was then to fly for a certain time when the controls were to be thrown out, allowing the device to pitch down to the earth, presumably on the target. It is reported that another effort included the guiding of such a device by radio from a following plane. Still another scheme seems to have called for fitting a bomb with gliding surfaces. The bomb would be carried by aircraft to the vicinity of the target where it would be released to glide to the target, being controlled by radio from the aircraft releasing it.

The difficult problem in connection with such a device is the development of the flying or gliding device, the bomb end of it being comparatively simple. Such a bomb would have a container filled with high explosive or chemical with a detonating train functioned by an "all-ways" fuze, which would insure operation regardless of the way in which the bomb struck. All of these bomb components have been developed and are available for application to any successful device which may be produced.

Antiaircraft Bombs

Antiaircraft bombs appeared during the war, being designed for use in attacks upon balloons and airships. These targets, with their gas bags filled with hydrogen, were particularly susceptible to destruction by fire. The original bombs consisted of small incendiary darts with claws which were dropped in large numbers. On striking their target they ignited and hung by their claws to the fabric of the gas bag, burning the bag and igniting the gas. Later bombs were filled with phosphorus and were burst by a time fuze above their target. The burning phosphorus was scattered and those particles which came in contact with the gas bag of the target would burn through the fabric and ignite the gas. These bombs were not very effective and were quickly replaced by the use of incendiary ammunition fired from aircraft machine guns when this ammunition appeared in service.

The development of antiaircraft bombs for use in attacking heavier-than-air machines has been suggested. Airplanes fly, for protection, in formation, so that if attacked they can bring to bear superior gunfire on their opponent and destroy him or drive him off. If such a formation can be broken up, the airplanes become separated and are then easy prey of attacking pursuit planes. It is proposed that attacking airplanes fly a predetermined height above a formation, and in the same direction, and it is believed that bombs may then be released with a very good chance of falling among the ships in the formation. If such bombs are equipped with time fuzes, which will be detonated after falling the distance in height between the formation and attacking airplanes, they should be very effective. If in addition, the fuzes are designed to function when an airplane is hit, the bombs will have an added chance of doing damage. There is some skepticism regarding the practicability of this form of attack. At the present writing very little work on these bombs has been undertaken.



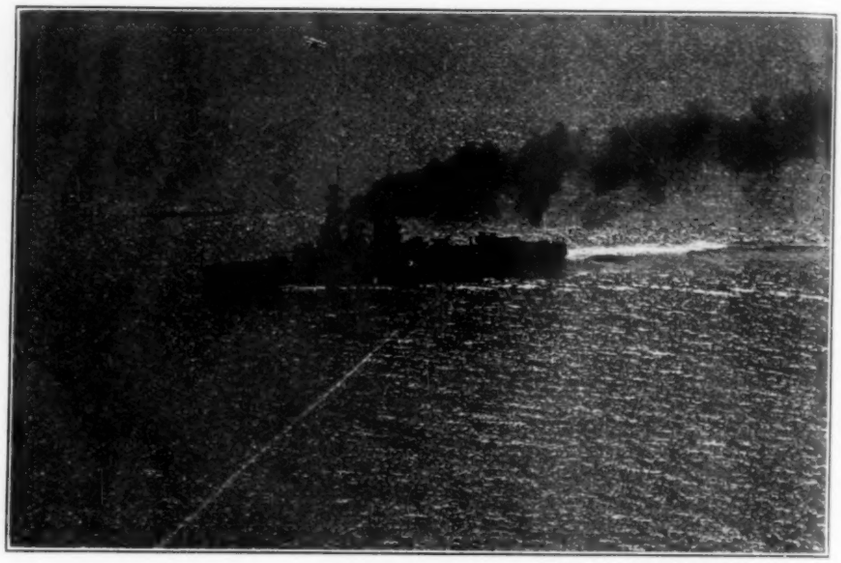
A Sub-Caliber Bomb
This is a British 3¾-pound bomb used for training purposes. The case is made of cast metal. A small charge of powder in a shot-gun shell is placed in a hole drilled through the case. The simple fuze in the nose fires the charge

Sub-Caliber Bombs

For the purpose of conserving the expensive service type bombs, a bomb has been developed, termed the sub-caliber bomb, for practice in training and for sighting shots in attack. It is small and designed to be produced at low cost. It is generally a cast iron slug with fins, a crude fuze and a charge of black powder, the last large enough to give a flash at night and a smoke puff in the day visible to the bomber, even from a high altitude, to indicate to him the point of impact. It weighs about eight pounds, and attempt is made to design it to have the same trajectory as the larger service types.

Early types of sub-caliber bombs were made of concrete, terra-cotta, or plaster of Paris. They, however, gave erratic flight and have given place to those with the small cast metal case. The charge of black powder is generally contained in a large shot-gun shell, and in some types this has been supplemented for visibility by the use of a chemical, titanium tetrachloride, which gives a smoke cloud when the container in which it is carried is burst by the powder charge and decomposing chemical is dispersed.

The chemical bombs are incendiary, gas, and smoke. They have a small explosive charge to cause them to function, but they get their designation from the main effect, which is produced by the chemical which they carry.



OFFICIAL PHOTOGRAPH U. S. NAVY

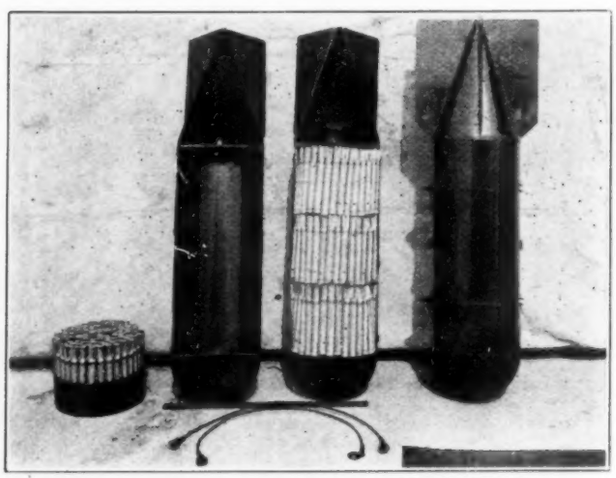
The Torpedo Hits Its Target

The airplane from which the torpedo was dropped is shown above the ship. The wake of the torpedo is shown in the left foreground

Incendiary Bombs

Incendiary bombs are those which destroy through burning. Their development was undertaken sometime after the use of explosive bombs was initiated, and arose from the desire to produce destruction through fire. They are divided into two classes, the "scatter" type, and the "intensive."

The former was the first experimented with in this country. The object of such a bomb is to scatter burning incendiary material over a large area with a view of destroying crops, woods and light wooden structures. Attempt was first made to ignite waste balls impregnated with oil and scatter them about. These were carried in a 50-pound bomb container and were ignited and scattered on impact by a black powder charge in the nose. In another design, balls of wood shavings soaked in paraffin, with phosphorus to ignite them, were projected from a container by a bursting charge ignited by a time fuze a certain time after the bomb was dropped. Neither of these bombs nor several similar ones were successful.



Containers for 8-ounce Smoke and Incendiary Bombs

These carry about 300 small bombs. On impact the container splits and the bombs are thrown out over a large area. The incendiary bombs are used to burn fields, woods, and light wooden structures. The smoke bombs are used to produce a ground smoke screen

The British developed apparently the most successful bomb of this type, called the baby incendiary bomb. This bomb weighs from six to eight ounces, and many of them are carried in a container. They are cylindrical in shape, are light and have a retarding disc soldered to the fin assembly to assist in guiding them in flight and to reduce their striking velocity. They carry an incendiary charge which burns for about thirty seconds with intense heat. On impact this charge is ignited and projected out of the case so that if the bomb penetrates the ground, the charge will be thrown clear of the hole and will land burning on the ground. The larger container which carries as many as three hundred bombs is designed to open just below the airplane and permit the bombs to scatter as they fall. They actually do cover a very large area. For the targets against which they may be used they appear to give very promising results and are probably the only type of bomb which will effectively destroy fields of grain, corn or wheat, or wooded areas. Naturally these can only be destroyed in this manner during certain seasons of the year.

Although not designed for use in bombing material targets, these small bombs dropped in large numbers were actually used in conjunction with demolition bombs in operations against these targets during the World War. It was thought that the demolition bombs would demolish the target and the incendiary bombs would initiate fires in the rubbish, which would spread, thereby increasing the destructive effect. Reports of bombers after a raid in which a combination of demolition and these incendiary bombs were used are to the effect that

after the attack, fires were observed to have been started in the bombed area.

The intensive incendiary bomb is one designed to ignite targets which are difficult to burn. The bomb is designed on the principle that a very hot spot must be produced and this spot fed by an incendiary material which will cause prolonged burning. The German and French bombs were generally in this class.

An American intensive incendiary bomb weighing about 50 pounds has been developed. The hot spot is produced by the combustion of thermit, a mixture of iron oxide and aluminum dust, which proceeds with the evolution of great heat and produces molten iron. This hot spot is fed by a solid oil emulsion which feeds the fire and burns about fifteen minutes. The thermit is carried in the nose, and the oil in the rear body of the bomb. Both are ignited on impact by nose and tail fuzes.

The ignition of the French incendiary bomb, constructed on a slightly different principle, takes place shortly after release and while the bomb is in the air. It then falls in flames. This feature was of some value during the war, for as the bomb fell in flames, it traced its path, and could be observed from the attacking airplanes, assisting the bombers in checking their sighting. This, however, was secondary to the real purpose for which the bomb was designed, and if now required, can be readily incorporated in a sub-caliber or special bomb.

The intensive type of bomb, however, is actually very ineffective, in so far as material damage is concerned. During the bombing of Paris only one fire was started by an incendiary bomb, and this was easily extinguished by two buckets of water. They must hit their target to be effective, and with the possibility of misses, it is evident that it is more advisable to carry demolition bombs instead, which even though they miss their target, may do damage of some kind. As pointed out before, demolition bombs have an incendiary effect.

The possibility of being bombed with fire is, no doubt, a cause of concern among uneducated classes of people and is most effective in lowering morale. This should not be lost sight of in selecting types of bombs for offensive operations. (Part III of this article will appear in the May-June number of ARMY ORDNANCE.)

Preparedness for National Defense

Although but a few years have elapsed since the World War, many of the weapons used in that mighty conflict are now regarded as obsolete, owing to the progress made in the development of more destructive devices.

What was considered as a great advance in the direction of industrial preparedness, as an insurance against war, formed the theme of an interesting and important discussion at a meeting held this week in New York under the auspices of the ARMY ORDNANCE ASSOCIATION and attended by representatives of various engineering societies in cooperation with the War Department.

A feature of the meeting was the reading, by Judge Elbert H. Gary, who presided, of a resolution adopted by the Board of American Iron and Steel Institute which placed the resources of the steel industry of the United States at the call of the government in the campaign for industrial preparedness.

In describing some of the new engines of warfare, designed by the Ordnance Department, Col. James F. Walsh, chief of the New York Ordnance district, told of an aerial bomb recently perfected which weighs 4,000 pounds, or ten times the weight of the largest bombs used in the great war.

The effectiveness of the new bomb is shown by the fact that it contains 2,000 pounds of explosives and "is capable of making craters 150 feet in diameter and fifty-seven feet deep." Colonel Walsh said this bomb has been constructed to be carried in the Martin bombing plane, and that the two form the heaviest demolition unit ever devised.

What was known in the war as the "caterpillar tractor," whose highest rate of speed was twelve miles an hour, has been superseded by an ordnance tractor capable of making thirty miles an hour up a 45-degree slope and of "going through water up to the driver's chin."

Other improvements designed by the department include a 75-millimeter gun "with twice the range of the French 75 used in 1918, while the redesigned 155-millimeter gun outranges the French by nearly five miles." It was also stated that the 50-calibre super-machine gun recently developed shoots a bullet weighing four tmies as much as the Browning, and throws it nearly three times as far.

Answering the question whether it was advisable to manufacture ordnance in quantity if these weapons become obsolete so quickly, Colonel Walsh said the department's decision was that it would go ahead with the manufacture of those certain to give reasonable satisfaction in battle and, what was more important, which could be manufactured in America in sufficient quantity and within reasonable time.

It was pointed out that while the United States has 17,000,000 men of military age, and many institutions were training men in the use of arms, "the youngsters in the shops seem to be forgotten, despite the fact that modern warfare entrusts to them the crux of the preparedness problem." The speaker contended that it was easier to teach a man how to use a rifle than how to make one, and urged the importance of instruction in the making of war weapons.

It was declared as the sense of the meeting, that it had nothing to do with going to war, but was emphatically in favor of industrial preparedness for any emergency, and to this end capital and labor should work together for the common defense.

Col. Dwight F. Davis, Assistant Secretary of War, said that "while America stands ready, by international agreement, to limit armies, and armaments," it was the duty of every citizen to play his part in the work of preparedness, and that there must be "no slackers and no profiteers."

A message was read from President Coolidge indorsing the purpose of the meeting, which looked forward solely toward securing the peace of the nation by being ready at all times to defend its interests. This accords with the opinion expressed by George Washington, who said that: "To be prepared for war is one of the most effectual means of preserving peace," and experience has confirmed the wisdom of this statement.—(*From: The Scranton (Pa.) Republican, February 9, 1924.*)

Letters to the Editor

The Mark VI Trench Mortar Fuze

Aluminum Screw Machine Products Co.,
EDGEWATER, N. J.,
February 6, 1924.

Editor, ARMY ORDNANCE,

Mr. Hawkes suggests in his article entitled "The Malfunctioning of Ammunition"—in the January-February issue of ARMY ORDNANCE under Trench Mortar Ammunition—that some prematures which have occurred with trench mortar fuze Mark VI have been caused by loose firing pins piercing the safety fork sufficiently to penetrate the primer and cause functioning of the fuze. I would very much question this as the correct cause of the trouble. I have seen quite a few prematures with this fuze, but they were all due to other causes.

Mr. Hawkes is no doubt familiar with the unfortunate premature at Aberdeen and the reason for same.

In the early development of this fuze, we had a lot of trouble with prematures due to the fork coming out too soon, that is, before acceleration ceased. This feature we thought we had overcome by putting a hook on the end of the fork.

I would rather suspect that long firing pins rather than loose ones has caused some trouble, providing the prematures occurred in the muzzle of the gun.

I never liked the way the primer was put in this fuze, but it will be somewhat of a job to make a change.

Have some tests actually been made with loose firing pins, or is Mr. Hawkes' conclusion more or less based on opinion? I can remember one test of this fuze where we fired six hundred or more rounds with no prematures and but one dud. To my way of thinking, this is quite a fuze. I think the "bugs" should be worked out of it, if there are any still in it.

Sincerely yours,

SETH G. MALBY.

Editor's Note.—When shown the above letter, Mr. Hawkes made the following statement:

"The Mark VI Trench Mortar Fuze has been developed to a degree where the usual weaknesses of design tending to produce prematures appear to have been eliminated. Even in the best design of fuze, however, accidental faults will creep in during production. The Mark VI Trench Mortar Fuze has been subjected to very extensive firing tests and has given excellent results, using the design as it now exists. About 6,000 of these fuzes, consisting of fuzes of various lots and manufactured by various contractors, were tested at the Aberdeen Proving Ground in the early part of 1920. A certain proportion of duds was obtained, and also one premature. In a previous firing a premature had been caused by dropping a shell into the mortar on top of another one, but in this latter case this mistake had not been committed. Examination of fuzes taken from duds revealed that, in a number of cases, the needle which is swaged into the striker was loose and that the web of the safety fork, which is nominally but .016-inch in thickness, was occasionally broken through. Two thousand complete sets of parts of the Mark VI Trench Mortar Fuze were sent to Picatinny Arsenal in 1920 for examination. The results were as follows: One needle was found to be loose; the web at the bottom of the slot on one safety fork was broken; and no needles were found of greater length than that required by the drawing.

From the above it would appear that in the present design there is a possibility of needles being loose, these needles being still further loosened by firing; and also, that the web of the safety fork may be so thin as to make it possible for this web to be broken through either in manufacture, assembly or in firing. No firings have been carried out using fuzes with the firing pin detached or almost detached from the striker, and with an extra thin or broken web in the safety fork, as the result of such a condition is apparent without actually destroying a mortar by the premature which would almost certainly result."

William Clows on The Use of Poison Bullets

THE JOHNS HOPKINS HOSPITAL
BALTIMORE, MD.

December 6, 1923.

Editor, ARMY ORDNANCE,

Those who are occupying themselves these days with discussions of what weapons may and may not be employed in civilized warfare, may be interested to know that as early as 1591, the practice of employing poison bullets was in disrepute, as is evidenced by the following quotation from a volume, "To all the Young Practizers in Chirugerie," by one William Clows, "Maister in Chirugery," printed by Thomas Orwyn for Wydow Broome (London) 1591:

"I asked his opinion (the "master gunner" of Portsmouth, England) if it were possible by his art and skill to poison a bullet of lead. He answered that he did know that a bullet of lead might be poisoned, and moreover, he said it was against the law of arms to shoot a poisoned shot. Again, it is present death if such shot be taken or found about any enemy, and I have since heard it confirmed by divers captains and old soldiers, who have said unto me, that they did know them who were executed for the same."

Clows prevailed upon his friend, the Master Gunner, to have discharged from a military musket, an arrow of the period. The target was a gate, some two hundred yards distant, and the arrow sank deep into the gatepost. Its feathers were not scorched, which confirmed Clows in his belief that the heat of discharge would not render impotent such poison as might be placed upon a bullet (this being a point on which professional opinions differed at that time). Of course, the wadding which was interposed between powder and arrow protected the latter, but Clows was not familiar enough with firearms (or "firy Ingines," as he calls them) to realize this.

Yours very truly,

C. H. GODDARD,
Major Ordnance, O. R. C.

The Influence of Confinement Upon Explosibility of Ammonium Nitrate*

By

J. L. SHERRICK

THE work herein reported is part of the general investigation on the explosibility of ammonium nitrate conducted under the direction of the National Research Council Committee on the Investigation of the Explosibility of Ammonium Compounds.[1]

In accordance with the recommendations of the National Research Council Committee, the small lead-block test[2] was adopted for use in these tests, the criterion of explosibility to be the compression of the small lead block, and all tests, unless otherwise specified, to be made at normal temperatures and with the ammonium nitrate at normal density (0.71).

Materials Used in the Investigation

Since the course of the decomposition of ammonium nitrate is influenced by impurities, it was deemed advisable to use a good grade of industrial nitrate as representative of the large quantities handled in storage and transportation in the industries.

Ammonium Nitrate.—This was "B.A.S.F. 550" ammonium nitrate contributed by the Hercules Powder Co. It analyzed as follows:

Constituent	Per Cent
Moisture	1.20
Insoluble matter	0.097
Ammonium Chloride	0.024
Sulphates	None
Nitrites	None

Its physical characteristics were found to be: color—buff; consistency—granular, coarse, wet, brittle particles, slightly cohesive; shaking density,[3] 0.71.

Military explosives used as boosters.—The characteristics of these boosters, which were definite chemical compounds, are shown in Table 1.

Amatol 80-20.—This was from a lot which had been melted and cast without stirring. There was considerable variation in the different portions of the cast, as shown by the following figures taken from eight analyses:

Constituent	Variation, Per Cent.	Average, Per Cent.
Moisture	0.04 to 0.06	0.05
Ammonium Nitrate	71.30 to 83.19	79.95
TNT	16.76 to 28.64	20.00

As the cast was broken up and thoroughly mixed, the average values represent fairly accurately the composition of the material used. Its shaking density was 1.00.

60 per cent gelatine dynamite.—The analysis of this gave the following:

Constituent	Per Cent
Moisture	0.59
Nitroglycerine Nitropolyglycerine	50.10
TNT	
Sodium Nitrate	35.35
Calcium Carbonate	1.20
Sulphur	0.70
Nitrocellulose	1.51
Carbonaceous Combustible Material	10.55

Its apparent specific gravity in cartridge form was 1.62.

40 per cent ammonia dynamite.—The analysis of this gave the following:

Constituent	Per Cent
Moisture	1.06
Nitroglycerine and Nitropolyglycerine	21.46
Sodium Nitrate	36.33
Ammonium Nitrate	27.38
Sulphur	0.60
Calcium Carbonate	1.35
Carbonaceous Combustible Material	11.82

Its apparent specific gravity, cartridged, was 1.19.

High-content ammonium-nitrate explosive.—The analysis of this gave the following:

Constituent	Per Cent
Moisture	0.49
Nitroglycerine and Nitropolyglycerine	9.02
Ammonium Nitrate	78.12
Sodium Nitrate	2.23
Calcium Carbonate	0.98
Carbonaceous Combustible Material	9.16

Its apparent specific gravity, cartridged, was 1.01.

Ammonium sulphate.—This was the c.p. analyzed material from the Baker & Adamson Co. Its shaking density was 0.97.

*Report III of the Committee on the Investigation of the Explosibility of Ammonium Compounds, National Research Council, conducted in co-operation with the Bureau of Mines. Published by permission of the Director, Bureau of Mines. Report IV will appear in a subsequent issue of ARMY ORDNANCE.

[1] The explosibility of ammonium nitrate, by C. E. Munroe: Chem. and Met. Eng., vol. 26, 1922, pp. 536-542. See also Fire risks with ammonium nitrate, by J. L. Sherrick.

[2] Methods for routine work in the explosives physical laboratory of the Bureau of Mines, by S. P. Howell and J. E. Tiffany: Tech. Paper 186, Bureau of Mines, 1918, 63 pp.

[3] The shaking density of any explosive material is determined at the Bureau of Mines Explosive Experiment Station at Bruceton, Pa., by the use of an apparatus which consists of a piece of Shelby tube 1¼-inch inside diameter, 1⅝-inch outside diameter, and 12 inches inside length, with a pipe cap on one end; a frame which allows the tube to be raised just 2 inches, thereby securing a constant height of drop for shaking the tube; and a small plunger which measures the depth to which the explosive has sunk after shaking. The base of the shaking frame is a piece of oak 2 inches thick and rests on a Trauzl lead block or other non-resilient material. The tube is filled to the top with the material under test If the material does not flow freely, the tube may be gently tapped to fill it. The tube is then placed in the frame and continually dropped from the 2-inch height until the surface of the explosive no longer sinks by continued shaking. The volume and weight relation gives the shaking density.

Table I.—Characteristics and Analyses of Military Explosives.

Explosive	Melting Point °C.	Solidification Point °C.	Moisture, Per Cent.	Insoluble Matter, Per Cent.	Acidity Per Cent.	Ash, Per Cent.	Sulphuric Acid (free and combined), Per Cent.	Nitrogen, Per Cent.	Shaking Density.
Grade I TNT	----	80.2	----	----	----	----	----	18.14	0.96
Picric acid	----	121.06	0.64	0.031	----	0.018	0.28	18.17	0.93
Tetryl	128.9	----	0.03	0.24	0.00	0.08	----	----	0.99
TNA	213.2	----	0.13	0.58	0.05	0.23	----	----	0.82

Table 2.—Results on Pressure-bar (after Robertson).

Explosive	Thickness of Steel Envelope, Inch.	Density of Loading.	Pressure in tons per sq. in. in 0.5x10-5 Second.*	Density of Loading.	Pressure.	Density of Loading.	Pressure.
Tetryl	None (paper)	--	14.2	1.45	---	1.55	---
	1/16	1.3	31.7	1.45	34.5	1.55	35.1
	1/4	1.2	51.2	1.45	55.9	1.55	57.8
	1/2	1.2	62.3	1.45	---	---	---
TNT	None (paper)	1.2	13.2	---	---	---	---
	1/16	1.2	---	---	---	1.55 (cast)	31.1
	1/4	1.2	46.1	---	---	1.55 (cast)	55.0
	1/2	1.2	56.2	---	---	---	---
Trinitrophenol	None (paper)	1.2	11.8	---	---	---	---
	1/4	1.2	43.3	---	---	1.6 (cast)	54.0
	1/2	1.2	50.2	---	---	---	---
Trinitro-m-xylene	1/4	1.2	41.5	1.45	43.7	---	---
m-Dinitrobenzene	1/4	1.2	32.9	---	---	---	---
2:4-Dinitrotoulene	1/4	1.2	31.1	---	---	---	---
Dinitronaphthalene (crude)	1/4	1.2	14.1	---	---	---	---
Nitrobenzene (liquid)	1/4	1.18	3.8	---	---	---	---
Nitrobenzene (solid)	1/4	1.2	3.8	---	---	---	---
Benzene (solid)	1/4	1.0	3.8	---	---	---	---

*With constant pellet interposed.

Electric detonators.—No. 8 electric detonators were used. These contained approximately a 2-gram charge of a mixture of 80 per cent fulminate of mercury and 20 per cent of potassium chlorate.

Preparation of Ammonium Nitrate

The ammonium nitrate as received contained 1.2 per cent of moisture, and was decidedly "wet," particularly in the portions near the top, bottom, and sides of the barrel. Since it was desired to have the nitrate dry, several hundred pounds were dried by exposing it to the air[4] on muslin bottom trays, at 110° F.

[4] "Fire risks with ammonium nitrate," by J. L. Sherrick, ARMY ORDNANCE, Vol. IV, No. 22, pp. 237-241.

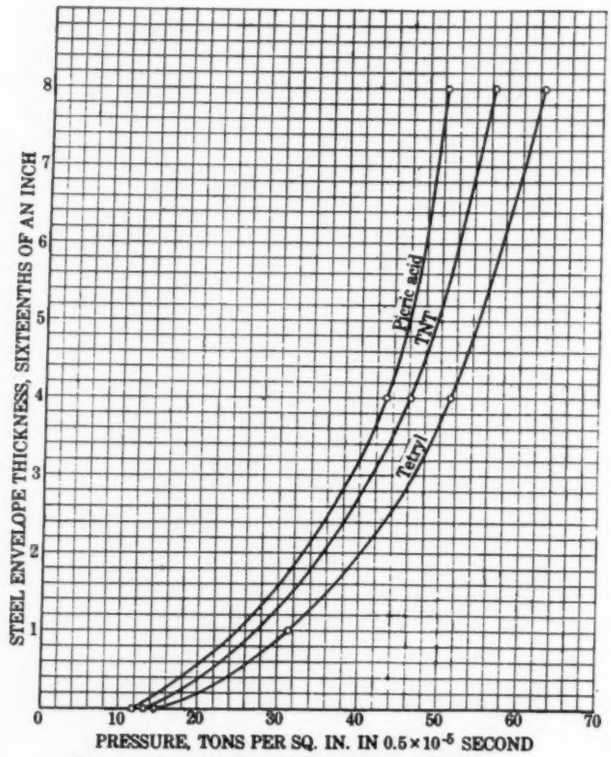


Fig. 1. Pressure Bar Tests of Three Explosives, Density of Loading 1.2

Preliminary Experiments

In some preliminary tests, using 100-gram boosters (tetryl, TNT, or 40 per cent ammonia dynamite), and a No. 8 electric detonator, no compression of the lead blocks was obtained. The ammonium nitrate recovered after these tests indicated that there had been very little, if any, explosion of the nitrate charge. Additional tests were made with the charge confined in ¼-inch wall Shelby steel tubing and, with charges similar to those just mentioned, the blocks were compressed about 28.5 mm. (63.5—35.0). This compression indicated the explosion of the nitrate charges, and showed that the confinement of the charge was a very important consideration.

The Effect of Confinement on the Action of Explosives

Results of tests on the pressure-bar apparatus devised by Hopkinson,[5] and developed at the Royal Arsenal at Woolwich, England, show that the pressure, effective in 0.5 x 10-5 second, produced by an explosive, is a function of the degree of confinement of that explosive. The results of tests with a number of explosives have been given by Robertson,[6] and are shown in Table 2.

Certain of these results are presented graphically in Figure 1, to show more clearly the effect of the various degrees of confinement. From consideration of the data in Table 2 it is seen that, for the explosives considered, the density of packing of the explosive is of relatively small importance compared with the degree of confinement. The results of this investigation show that this is not true for ammonium nitrate.

As the effective pressure developed in 0.5 x 10-5 seconds represents the hammer blow struck by the explosive, it may be taken as a measure of the efficiency of the several explosives as boosters.

The confinement of the charge might be expected to affect the results, first, by increasing the power and effectiveness of the booster, if it be confined; and, secondly, by increasing the effective pressure of the ammonium explosion upon the lead block.

[5] Hopkinson, Bertram, A method of measuring the pressure produced in the detonation of high explosives or by the impact of bullets: Phil. Trans., 1914 (A), 213, 437.

[6] Robertson, Robert, Some properties of explosives: Trans. Chem. Soc., Vol. 119, 1921, pp. 1-29.

Table 3.—Comparison of Properties of Two Ammonium Salts.

Salt	Molecular Weight	Sp. Gr.	Melting Point °C.	Decomposition Point °C.	Crystalline Form Rhombic
Ammonium Nitrate	80.05	1.725 (15°)	158	210	16°—32° C.
Ammonium Sulphate	132.14	1.7687 $\frac{20°}{4°}$	140	280	Rhombic

The Effect of Various Degrees of Confinement of Charge Upon the Compression of Lead Blocks

The desired variation in the degree of confinement was obtained by the use of the following: 28-gage galvanized iron tubing, 1½-inch inside diameter, with lapped soldered longitudinal seam; Shelby tubing 1⅝-inch outside diameter with walls 1 1/16-inch in thickness; Shelby tubing 1¾-inch outside diameter with walls ⅛-inch in thickness; and Shelby tubing 1.9 inches outside diameter with walls ¼-inch in thickness. The methods of using these various forms of tubing are shown in A and B, Fig. 2. The assembly used with all tubing is shown in A, except for that with ¼-inch walls, which is shown in B.

In conducting these tests, the ammonium nitrate was first loaded into the tube at its normal shaking density directly in contact with the steel disc; the booster was loaded directly on the ammonium nitrate at the normal shaking density for the booster used; the electric detonator was then inserted centrally in the booster charge, extending into the charge ½-inch, and the charge fired in a bomb proof.

As there was always a certain amount of compression of the lead block due to the booster, parallel blank tests were run, using ammonium sulphate in place of ammonium nitrate so as to judge more accurately whether or not an explosion of the ammonium nitrate had taken place. Ammonium sulphate was selected because it was similar to ammonium nitrate in general properties and yet was not, as far as known, capable of being detonated. The properties of these two salts may be compared in Table 3.

The results of the tests are given in Table 4.

Obviously we could not expect to obtain absolute net values for the ammonium nitrate compression by subtracting the values obtained with ammonium sulphate and booster from values obtained with ammonium nitrate and booster, because the extent to which underlying ammonium nitrate detonated would influence the transmission and registration of the compression wave from the booster charge. This conclusion is justified by the results of tests with 40 per cent straight dynamite. These tests[7] were made with varying weights of charge of explosive packed in 1½-inch Manila paper tube, with detonator inserted directly into the explosive. The results obtained were as follows:

Weight of Explosive, Grams.	Compression of Lead Block, mm.
30	14.3
40	16.9
50	17.8
60	18.8
70	20.8
80	20.9
90	21.6

[7] Unpublished results of tests conducted by S. P. Howell and J. E. Tiffany at the Explosives Experiment Station, U. S. Bureau of Mines, at Bruceton, Pa.

Table 4.—Small Lead Block Tests of Ammonium Nitrate and of Ammonium Sulphate With Varying Confinement.

Booster Charge (grams) Main Charge, Nature	Compression of Lead Block (mm.) 25 Nitrate	25 Sulphate	50 Nitrate	50 Sulphate	100 Nitrate	100 Sulphate
TNT						
Charging conditions						
Galvanized iron tube	---	---	---	---	1.0	0.5
1/16-inch wall Shelby tube	7.5	6.0	9.0	9.0	13.5	11.0
1/8-inch wall Shelby tube	16.5	4.5	20.0	17.5	23.5	15.5
1/4-inch wall Shelby tube	24.0	13.0	29.0	20.0	29.0	20.0
Tetryl						
Charging conditions						
Galvanized iron tube	---	---	---	---	2.0	1.0
1/16-inch wall Shelby tube	9.0	7.0	12.0	10.0	14.5	11.5
1/8-inch wall Shelby tube	18.0	6.5	23.5	15.5	26.0	17.0
1/4-inch wall Shelby tube	26.5	14.5	31.0	18.0	30.5	20.0
Picric Acid						
Charging conditions						
Galvanized iron tube	---	---	---	---	2.0	1.0
1/16-inch wall Shelby tube	10.0	6.5	11.5	9.0	14.0	10.5
1/8-inch wall Shelby tube	21.0	4.5	24.5	18.0	24.0	15.5
1/4-inch wall Shelby tube	28.5	12.5	30.0	16.5	31.5	18.0
TNA						
Galvanized iron tube	---	---	---	---	2.0	1.0
1/16-inch wall Shelby tube	10.0	7.0	12.5	10.5	12.0	11.0
1/8-inch wall Shelby tube	21.0	6.5	23.5	15.0	22.5	17.0
1/4-inch wall Shelby tube	27.5	15.5	30.5	15.5	33.0	17.5
40 per cent ammonia dynamite						
Charging conditions						
Galvanized iron tube	---	---	---	---	1.0	0.5
1/16-inch wall Shelby tube	5.5	4.5	8.5	8.0	11.0	9.5
1/8-inch wall Shelby tube	16.5	4.5	20.0	8.5	22.0	15.5
1/4-inch wall Shelby tube	24.0	10.5	24.5	15.5	28.0	15.5
Amatol 80/20						
Galvanized iron tube	---	---	---	---	1.0	0.5
1/16-inch wall Shelby tube	3.0	3.5	5.0	6.5	10.0	9.5
1/8-inch wall Shelby tube	16.5	3.0	19.5	13.5	23.5	15.5
1/4-inch wall Shelby tube	23.5	9.5	27.0	13.0	27.5	17.5
60 per cent gelatin dynamite						
Galvanized iron tube	---	---	---	---	0.5	0.5
1/16-inch wall Shelby tube	4.5	6.0	5.5	8.5	8.5	11.5
1/8-inch wall Shelby tube	16.5	6.5	18.5	11.5	20.0	16.0
1/4-inch wall Shelby tube	23.5	10.0	26.5	19.0	29.0	18.0
High content ammonium nitrate explosive						
Galvanized iron tube	---	---	---	---	1.5	0.5
1/16-inch wall Shelby tube	7.0	6.0	10.0	8.5	13.0	8.0
1/8-inch wall Shelby tube	17.5	7.0	23.0	16.5	24.0	16.0
1/4-inch wall Shelby tube	25.0	11.5	30.5	15.5	33.5	17.5

Table 5.—Small Lead Block Tests of Ammonium Nitrate With No. 8 Electric Detonator Without Booster in ¼-Inch Wall Shelby Tube.

Ammonium Nitrate Grams.	Height of Charge, cm.	Lead Block Compression mm.	Remarks.
50	6.2	3.5	Tube was not split or broken; 1 cm. compressed nitrate remained.
100	12.4	4.5	Tube cracked for 5.5 cm., and 3.75 cm. of compressed nitrate remained.
200	24.8	0.0	Upper 10 cm. of tube broken up badly; 13 cm. compressed nitrate remained.
(137 of ammonium sulphate)	12.4	0.0	Tube exactly as before shot.

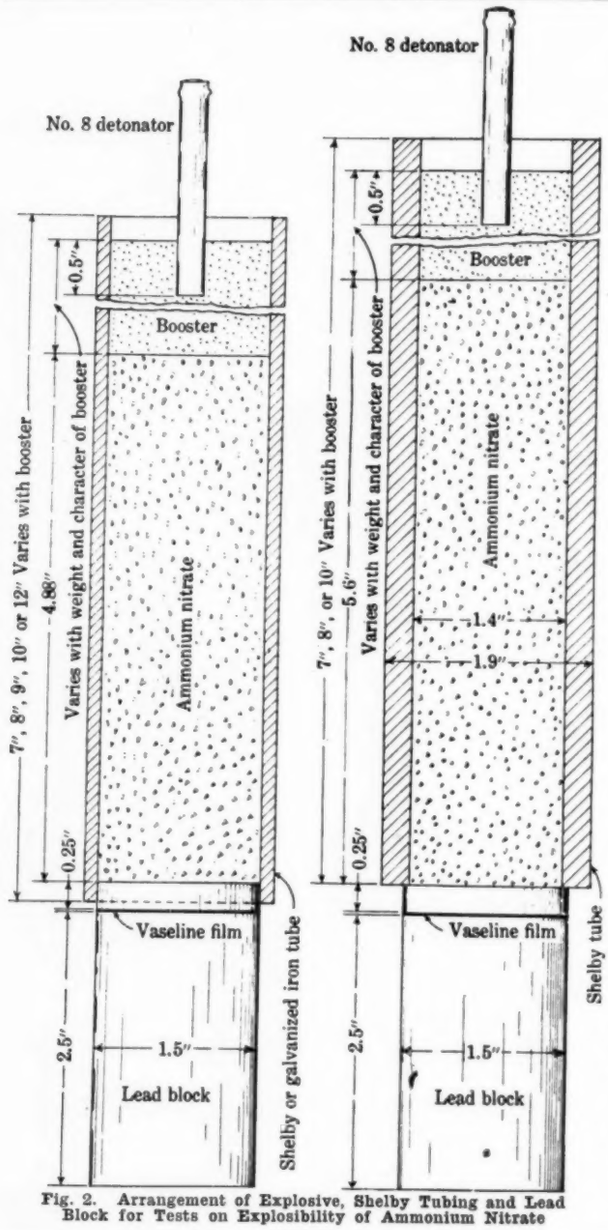


Fig. 2. Arrangement of Explosive, Shelby Tubing and Lead Block for Tests on Explosibility of Ammonium Nitrate

In the tests with ammonium nitrate and booster any one of three conditions may obtain—namely, (1) the ammonium nitrate, as a whole, failed to detonate, and here as with the ammonium sulphate the entire effect of the booster was registered in compression of the lead block; (2) part of the ammonium nitrate detonated, and the compression produced on the lead block was due in part to the effect of booster and in part to the ammonium nitrate, such compression in some cases giving negative results when computed to net values; and (3), the entire charge of ammonium nitrate detonated and very little of the effect of the booster was registered in compression of the block.

A comparison of the compression values (Table 4) obtained with ammonium nitrate and ammonium sulphate indicates that there was complete detonation of the ammonium nitrate charge with any of the quantities of all the boosters used when the charge was confined in ⅛ or ¼-inch wall Shelby tubing. A number of tests were therefore made on ammonium nitrate charges confined in ¼-inch wall Shelby tubing without a booster, but with the No. 8 electric detonator inserted directly into the charge. The results of these tests are shown in Table 5.

These tests indicate that with the confinement used even a No. 8 electric detonator will initiate the detonation of the ammonium nitrate. It is apparent that the detonation so initiated soon dies out.

Efficacy of the Various Explosives Used as Boosters for Ammonium Nitrate

As all of the explosives used as boosters seemed to serve fairly well for detonating confined charges of ammonium nitrate, it was rather difficult to conceive of any basis for classifying them according to their efficiency. In any event it would seem that such classification should be based only on those results where complete detonation of the ammonium nitrate was indicated. If the classification is made according to the compression of the lead blocks with charges of ammonium nitrate at normal density (0.71), with 100-gram booster charges and ¼-inch wall Shelby tube confinement, the grading is as follows: High content ammonium nitrate explosive, TNA, picric acid, tetryl, TNT, 60 per cent gelatin dynamite, 40 per cent ammonia dynamite, amatol 80/20; high content ammonium nitrate explosive being the most efficient and amatol 80/20 being the least.

In the grading of the various explosives according to

Table 6.—Compression (mm.) of Small Lead Blocks With (100 grams) Unconfined Booster Charges and Confined Ammonium Nitrate Charges.

Booster (100 grams) Confining tube	TNT	Tetryl	Picric Acid	TNT	40 Per Cent Ammonia Dynamite	Amatol 80/20	60 Per Cent Gelatin Dynamite	High Content Ammonium Nitrate Explosive
1/16-inch wall Shelby	---	---	---	---	7.0	---	5.5 (5.5)*	---
1/8-inch wall Shelby	---	---	---	---	16.5	---	17.0	---
1/4-inch wall Shelby	25.0	24.5	25.5 (8.5)*	27.0	25.0	28.5	23.0	26.0

*Values are from ammonium sulphate blank tests.

their efficacy as boosters, explosives containing ammonium nitrate are placed at widely varying parts of the classification so that no generalization regarding them is possible. The greater efficacy of TNA over 40 per cent ammonia dynamite and amatol 80/20 seems, however, to oppose the "synchronous vibration" theory of detonation.

Relative Effects of Confinement of Booster and of Ammonium Nitrate Charge

Since, according to our interpretation of the significance of results obtained on the pressure-bar apparatus, confinement would not only influence the effectiveness of an explosive as a booster, but would affect the compression of lead blocks, it was felt that valuable information might be obtained by varying the confinement of the booster and the confinement of the ammonium nitrate charge independently. Such a series of tests was therefore made with results as recorded below.

Tests with Unconfined Ammonium Nitrate Charge and Confined Booster Charge

The ammonium nitrate was loaded in Manila paper in direct contact with the steel disc. The Manila paper tube was cut off flush with the top of the ammonium nitrate charge, and a 6-inch piece of ¼-inch wall Shelby tube was placed directly on top. The booster, 100 grams of high-content ammonium nitrate explosive, was loaded in the tube in direct contact with the ammonium nitrate, and fired by means of a No. 8 electric detonator. There was no compression of the lead block in any of the several tests run.

Tests with Confined Ammonium Nitrate Charge and Unconfined Booster Charge

In this series of tests the confining tubing extended only to the top of the ammonium nitrate file. The booster, in each case, was enclosed in Manila paper, and was in direct contact with the ammonium nitrate. Table 6 shows the results of these tests.

The values of compression, as shown in Table 6 for tests with unconfined booster charges, are somewhat less than values obtained with confined boosters. This was, however, to be expected, as according to the analysis of results on the pressure-bar, such unconfined boosters would be less effective as initiators. With these small lead block tests, the ¼-inch steel wall confinement of booster increases the compression of the lead block only 12 per cent over that obtained with unconfined boosters, whereas, with results on the pressure-bar, the ¼-inch steel wall confinement increased the effective pressure per square inch in 0.5 x 10-5 second by 260 per cent. Such comparison serves to show that very little of the force of the boosters was registered in the compression of the blocks, and indicates the complete detonation of the 100-gram ammonium nitrate charges.

The small lead block test is not of sufficient sensitiveness to determine whether or not any partial detonation of the unconfined charges takes place, and it may not be possible to obtain any direct evidence of such detonation; but it is entirely probable that even in unconfined charges the layers of nitrate directly in contact with the booster detonate.

It was shown that although a No. 8 electric detonator by itself brought about the detonation of half of a 100-gram charge confined in a ¼-inch wall tube, the second half of the charge did not detonate. It would seem therefore that any detonation of the ammonium nitrate is the result of an induced wave of detonation from the booster or initiator, and that such wave is propagated with diminished rate and intensity as it proceeds. The distance to which the detonation is propagated depends upon the rate and intensity of the wave induced by the booster, and the conditions under which the ammonium nitrate charge is placed. Apparently, for ammonium nitrate in 1½-inch files at normal temperature, the detonation is not self-sustaining.

Since ammonium nitrate may exist in a number of different physical modifications, and as the stabilities of these modifications may be different, the action of each modification as an explosive may also be different. A series of tests on each of the several modifications is to be undertaken, and will consist of tests at the various temperatures necessary to ensure the occurrence of those modifications desired.

Conclusions

1. Confinement is very effective in promoting the detonation of ammonium nitrate charges.

2. The detonation of ammonium nitrate appears to be the result of an induced wave of detonation from the booster or initiator, and such wave is propagated with diminished rate and intensity as it proceeds. The distance to which the wave is propagated depends upon the rate and intensity of the induced wave and certainly also upon the degree of confinement of the nitrate charge.

3. From the standpoint of their efficacy as boosters for ammonium nitrate, the various explosives may be graded as follows: High content ammonium nitrate explosive (nitroglycerine 9 per cent), TNA, picric acid, tetryl, TNT, 60 per cent gelatin dynamite, 40 per cent ammonia dynamite, amatol 80/20; high content ammonium nitrate explosive being the most efficient and amatol 80/20 being the least efficient.

4. The influence effect, assumed in the "synchronous vibration" theory of detonation, is not apparent in the efficiency grading based on the experimental results.

(Report IV of this investigation, "The Influence of Density of Packing Upon the Explosibility of Ammonium Nitrate," by Dr. Sherrick, will appear in the May-June number of Army Ordnance. This report will conclude the series.)

Professional Notes

The Unilateral System of Tolerances

By Eugene C. Peck

Why do we need a national standard system of dimensional tolerances? What part do these tolerances play in the commerce and manufacture of the world?

They are needed for many purposes too numerous to discuss in this brief article, but the most important or primary reason for the use of standard systems of tolerances is to make possible interchangeable manufacture. No discussion of any tolerance system should have recognized weight which does not have interchangability as its ultimate goal.

The greatest economic use of labor is found in quantity production of mating parts by interchangeable manufacture. This method of manufacture also gives to the consuming public the greatest value for the purchase price and the best service in renewal of repair parts. As a direct result of interchangeable manufacture the cost of many commodities has been brought within the means of the general public, thereby still further increasing the economies to be derived from quantity production.

Interchangeability Defined

There are several degrees of interchangeability. Strictly speaking, interchangeability consists in making the different parts of a mechanism so uniform in size and contour that each part will fit and properly function in any one of the whole number of mating parts, no matter when or where it is made. It will be noted that this definition means that each part of the mechanism of a certain model will fit any of the mechanisms of the same model, regardless of the lot to which it belongs or the year in which it was made. However, as often defined, interchangeability consists in making each part fit any mechanism in a certain series; that is, the interchangeability exists only in the same series.

Selective assembly is sometimes termed interchangeability, but it is merely assembly without fitting. It is used where close work and good fits are desired and consists in selecting by trial the largest internal members and assembling them with the largest external members, thus limiting the freedom of fits and still allowing a reasonable tolerance in machining. The following example will serve as an illustration: If ten 1-in. holes should vary from standard size to 0.001 in. oversize and ten shafts were selected from a lot which gave the desired kind of fit in each pair of mating parts, they would function properly without fitting; but it is evident that the largest of these shafts would not interchange with the smallest holes and give the desired results if good fits were required. Therefore interchangeability by this method is very limited and should be so recognized.

It will be noted that the strict definition of interchangeability given above does not imply that the parts must always be made without hand work, although that is usually considered desirable. It does mean, however, that when the mating parts are finished, by whatever process, they must assemble and function properly, without fitting individual parts one to the other. On this point hinge some of the controversies on interchangeable manufacture and the advisability of its application.

It must be realized that the rapid production of a large number of interchangeable parts such as was demanded during the World War necessitates their manufacture in a number of separate shops. For all of these parts to be within the specified limits for size requires that each shop must first have master gages representing as exactly as possible these limits. To produce a number of master gages which shall be identical within very close limits presupposes the existence of linear standards that are accurate and identical all over the manufacturing world, or else the production of the master gages by a single concern which has accurate standards.

In a pair of mating parts that move freely, there is a space or clearance between the mating surfaces. This space is large or small according to whether the fit is loose or tight. If this space be gradually reduced, a condition will ultimately be reached in which there is no space or clearance between mating surfaces, that is, they fit metal to metal without shake. Then any movement of the mating parts one within the other will require some force, and if the surfaces are accurate and smooth, both members are then of the same size. The dimensions of the parts making this fit should then be regarded as having the exact standard or basic size.

This is the place at which interference of metal begins, often termed the zero point or zero line. Tolerances and allowances are considered as plus above this line and minus if below it.

This zero line is then the place at which interference of metal begins to take place, and it should represent the exact standard or basic value of the dimensions because a correct pair of mating standard gages check the dimensions of a pair of mating parts against interference. This means that the minimum dimension of the external member and the maximum dimension of the internal member of a pair of mating parts that fit without shake are standard or basic. This fit without shake is the most difficult class of fit to make. The standard gages purchased in the open market are the "go" gages for this fit and serve to check for an interference of metal.

Strict interchangeability can be maintained only when the interference of metal between mating parts takes place at a point which bears a fixed relation to the basic or standard dimension. This is so obvious that it scarcely even needs explanation. It must be plain that if every firm agreed that the zero or interference line should be 0.001 in. over basic and worked to this system, universal interchangeability could be maintained. It must be equally plain that if one firm adopted the plan of having the zero line or point at which interference takes place 0.001 in. over basic or standard, another 0.001 in. below basic or standard, and still another at a point exactly agreeing with basic or standard, there could be no strict interchangeability of mating parts among these three firms. Such a condition is exactly analogous to a variation in the values of linear standards. If the American inch was 0.001 in. smaller than the British and 0.002 in. smaller than the French, interchangeability of product among these countries would be lost, even though the workmanship was perfect in each case.

This feature of having the basic or standard gage determine the line at which interference of metal takes place is quite valuable, because these gages alone will check product against interference and the mating parts are bound to go together. It should be noted that there is a very large amount of work made all over the country in which fits are not essential but the parts *must go together freely.* Therefore for this interchangeability and the maintenance of nominal-sized product it is a great advantage to be able to inspect against an interference with a set of standard basic gages.

Two Tolerance Systems Compared

It seems impossible to put too much emphasis on the basic or fundamental fact that where interchangeability is desired there must be a fixed and unchanging point in relation to the basic or standard at which the interference of metal takes place. The master gages or standard gages of nominal sizes ordinarily available everywhere conform to the fundamental condition that they are produced under ideal conditions and are identical within any limits now being discussed. A system dependent directly on these standard gages for checking the wear limit of the "go" gages is inherently superior to one dependent on another set of master gages whose limits are at variance with the standard gages of nominal size.

The Unilateral System of tolerances complies exactly with this basic principle, while the Bilateral System violates it.

Strict interchangeability demands control of the dimensions of the minimum external and maximum internal members. If the interference of metal is intentional, as in tight fits, control of these two dimensions is also the important factor as well as in free fits in order to prevent the assembly of mating parts that are too tight. There should be no confusion or misunderstanding in regard to the assembly of mating parts by interchangeable manufacture—the parts will assemble and function when no external member is smaller than the prescribed limit, and no internal member is larger than the prescribed limit. No gaging system can be set up, however, which depends on the use of worn gages, because gages do not wear uniformly in either size or contour and hence cannot control either of the limiting dimensions when worn. It is a delusion to think that either on account of gage wear, gage tolerance, or for any other reason, the zero point can be crossed without destroying practical and economical interchangeability.

For analysis and comparison consider a hole made for three classes of fit: snug, 1.000 in. ±0.0005; free, 1.000 in. ±0.001; loose, 1.000 in. ±0.002, as dimensioned by the Bilateral System. A glance indicates immediately three minimum as well as three maximum holes. The zero point or interference of metal takes place respectively 0.0005 in., 0.001 in. and 0.002 in. below the basic size of 1.0000 in. This will require three "go" gages none of which are basic, all being special. The resulting pieces if made in large quantities will have to be stored separately to obtain the kind of fit desired and to prevent an interference of metal with shafts made for a higher grade of work.

The limit gages used in this system cannot be handed down to the next succeeding poorer grade of fit without refinishing because they will be worn to a taper. There will also be the cost of remarking them for the new class of fit. The same may be also said of the solid reamers. From the largest solid reamer that could be used to the smallest for all three fits, before it is thrown away, there is a wear of 0.004 in. under ideal conditions.

Using the same example but the Unilateral System of tolerances, the hole dimensions become:

$$\text{Snug Fit, 1.000 in. } {}^{+0.001}_{-0.000} \qquad \text{Free Fit, 1.000 in. } {}^{+0.002}_{-0.000}$$

$$\text{Loose Fit, 1.000 in. } {}^{+0.004}_{-0.000}$$

We have at once one uniform minimum hole and that is basic 1.0000 in. The Standard 1-in. plug is the "go" gage for all three classes of fits. The interference of metal takes place at the same unvarying zero point, the basic dimension. There is required one standard gage for the "go" gage which can be bought in the open market, for all three fits as against three special "go" gages for the Bilateral System. There is, however, no difference in gage cost in either system for the "not go" gages.

In manufacture the holes are quite commonly and may well be made with the same tools; inspection will pass, in either system, all holes which the "not go" gage for the snug-fit class will not enter.

In the Unilateral System if the same "go" gage accepts all of these pieces as well, every one of them can be used for interchangeable assembly for any one of the three classes of fits without further classification. In the Bilateral System three inspections with three different "go" gages will have to be made and the holes belonging to each class of fit kept separate with the attendant trouble and losses. It is claimed by the opponents of the Unilateral System that this method of inspection will pass more pieces by the Bilateral System, but this is not true as a little thought will show. The machining ability of the operator being equal in each case, the same number will be passed by each system as the extreme tolerance limits are the same, 0.004 in. in each case.

The wear life of a tool depends, all factors being equal in each case, on the amount the tool is over the minimum hole size at the beginning of its life, and not on the relation of the size to the basic or standard. It is the practice in the United States to make all solid reamers slightly over basic for wear life, and not exactly standard, as some reamers suppose.

In interchangeable manufacture in the United States it is the predominating practice to use adjustable reamers, returning them to the toolroom for correction as soon as the standard plug gage will not enter the holes. Years of experience have made plain that this procedure maintains accuracy and quality of holes at a low cost, at the same time makes possible the transfer of the skill of a good toolmaker through the toolroom to the machine operators, and best of all provides for strict interchangeability.

Indicating Tolerances

It will now be shown that the work of dimensioning and revising tolerances on drawings is less for the Unilateral System, requires less mental effort, and therefore tends toward economy and accuracy.

It is almost universally agreed that *allowance* or minimum clearance is a designer's term and from his standpoint the important factor in a fit. This is certainly true if the designer is really competent, and as he is responsible for the proper functioning of the mechanism he has a right to insist on the accepted fundamental, namely, that allowance (neutral zone or minimum clearance) must never be encroached upon from any cause.

The important factor, from the manufacturing standpoint, is the *tolerance* allowed.

Thus allowance and tolerance are each required by two different parties, sometimes so widely separated as to never even see each other. They must not therefore be confused nor tampered with by the wrong party or trouble will ensue.

To illustrate, let it be assumed that a designer desires a hole with a free-running shaft and has decided that an allowance of 0.001 in. is sufficient. That is, he will make the hole 1.000 in. standard and the shaft 0.999 in. This represents his ideal condition of this pair of mating parts for the job intended. If he plans to make only one pair, this is all that is necessary and the toolmaker could make the parts without trouble. This establishes the fact that 0.001 in. is the clearance between the mating surfaces of this pair, and this is the minimum requirement.

Suppose, however, it is desired to make, say, 10,000 of these pairs and it is decided to allow 0.001 in. tolerance on each member. The dimensions then become (by the Unilateral System):

$$\text{Hole, 1.000 in. } {}^{+0.001}_{-0.000} \qquad \text{Shaft, 0.999 in. } {}^{+0.000}_{-0.001}$$

It will be seen from the above that the main dimensions show at a glance what is the allowance, or the tightest fit. Attention is also called to the fact that these main dimensions also represent what is commonly called "maximum metal." Increasing the metal in either member will make a tighter fit than is permissible. This, then, should be the rule for dimensioning drawings: Main figures indicate maximum metal or tightest fit permissible.

Tolerance should always be applied in a direction to produce greater looseness of fit, as this is the only sacrifice that can be permitted for variation in manufacture.

If for any reason tolerances must be changed, a single dimension only for each member need be altered and the tightest fit is not interfered with. It will be noted that changing the tolerances on either of these members permits the use of the same "go" gages without change.

In the Bilateral System the designer, having established his tightest fit at the same dimensions, i.e., hole 1.000 in., shaft 0.000 in., applies the tolerance to the hole 1.000 in. ± 0.0005 in. and this establishes his minimum hole as 0.9995 in., from which he subtracts 0.001 in. for his allowance. This gives him the maximum shaft 0.9985, from which he again subtracts his 0.001 in. tolerance, arriving at the minimum shaft as 0.9975 in. He may dimension these parts several ways thus:

$$\text{Hole} = 1.000 \text{ in.} \pm 0.0005 \text{ in.} \qquad \text{Shaft} = 0.999 \pm 0.005 \text{ in.}$$

$$\text{or Hole} = \begin{cases} 1.0005 \text{ in.} \\ 0.9995 \text{ in.} \end{cases} \qquad \text{Shaft} = \begin{cases} 0.9985 \text{ in.} \\ 0.9975 \text{ in.} \end{cases}$$

$$\text{or Hole} = 1 \text{ in.} \pm 0.0005 \text{ in.} \qquad \text{Shaft} = 1 \text{ in.} \, {}^{+0.0015 \text{ in.}}_{-0.0025 \text{ in.}}$$

In none of these can the tightest fit be determined without considerable mental effort. Changing the tolerances on the hole means changing one dimension by the first and third method of dimensioning, two by the second method. Changing the tolerance on the shaft when the hole has been changed as well, means changing two dimensions regardless of which of the three methods are used, with the attendant extra care and chance for error. Attention is also called to the fact that changing the tolerance destroys the old zero point at which interference of metal takes place and sets up a new one which may in many cases prevent the assembly of parts previously accepted. Such a change would plainly destroy the assurance that renewals would fit the original parts. It should be noted also that both the "go" and "not go" gages for each member are no longer acceptable under the new dimensions, but must be retained for use in making repair parts for those mechanisms made before the tolerances were changed.

Summary

The experience of the writer, covering thirty years of active work in connection with both the making and the use of tools for accurate manufacturing by all of the systems in use during that time, leads him to believe beyond question that the Unilateral System of tolerances has the following proven advantages:

a It provides the only practical means of maintaining strict interchangeability in manufacture.
b It is more economical to manufacture by this system due to its simplicity.
c The gage cost is less.
d The cost of dimensioning drawings is less.
e The mental effort of dimensioning drawings is less.
f Tolerances may be changed without destroying the zero point at which interference takes place. Changing the position of this zero point may prevent the assembly of parts already made.
g Permits the standard calibrated gage to settle any controversy regarding the interference of metal between mating parts.
h Permits the standard calibrated gage to control the minimum dimensions of the external member.
i Simplifies the handling of small tools and gages in the toolroom.

Basic Hole or Basic Shaft

There seems to be some confusion in the minds of many concerning the relation between the adoption of a standard tolerance system and the decision as to which of the two mating parts should be considered basic. Or in other words, which side of the zero line the tolerance for a free running fit should be placed.

If the allowance is taken from the shaft or internal member, the minimum hole becomes basic. If, on the other hand, the allowance or neutral zone is obtained by removing various amounts of metal from the hole or external member, the maximum shaft becomes basic.

In the writer's opinion there has been altogether too much controversy over basic hole and basic shaft. As a matter of fact there are conditions under which both the hole and shaft are basic and there are conditions under which neither of them is basic.

It must be understood that neither shafts nor holes can be made in quantity without a tolerance. This being true, there can literally be no basic hole or basic shaft. However, as shown in the preceding part of this article, in the actual fit of metal to metal both hole and shaft are basic. In all of the other fits the minimum hole only is basic, the tolerance permitting the holes to be above basic.

It is believed that in the foregoing part of this article it has been shown that the most economical practice and true interchangeability are best obtained by having the interference of metal take place at the basic dimension. This, then, seems to be the governing point, and there is only one exception to the universal application of this rule. This exception is transmission shafting or its equivalent in which a commercial article is used in a way that requires a variety of fits on the same member. This forms a special case in which the holes may well be made to suit this uniform internal member.

However, standard shafting is now and has always been intended to be made to the basic size with the tolerance minus, and this practice does not entirely substitute basic shaft for basic hole, because some of the shafting will be undersize on account of using the tolerance, and hence will produce a more or less free fit. The shafting never being over basic means that a drive fit could only be made with a hole smaller than basic, hence this part of the manufacture would involve a slightly special case. This special case need not, however, interfere with the general standard system as outlined above, because it belongs in a class of machinery slightly divorced from the manufacture of interchangeable machine parts.

The writer's opinion is that the sooner basic hole or basic shaft is forgotten the sooner we can get down to a usable and workable system.

Made-to-order material including fits is not to be confused with the interchangeable product previously referred to. Made-to-order fits can only be made to the dimensions given or to fit a sample submitted. These, then, belong to no system of fits or tolerances and it matters little whether the shaft or hole is basic.

The great bulk of manufactured mating parts are most economically made, and interchangeability is best maintained when the minimum hole is basic and the interference of metal begins at this basic dimension.——From: *Mechanical Engineering*, December, 1923.

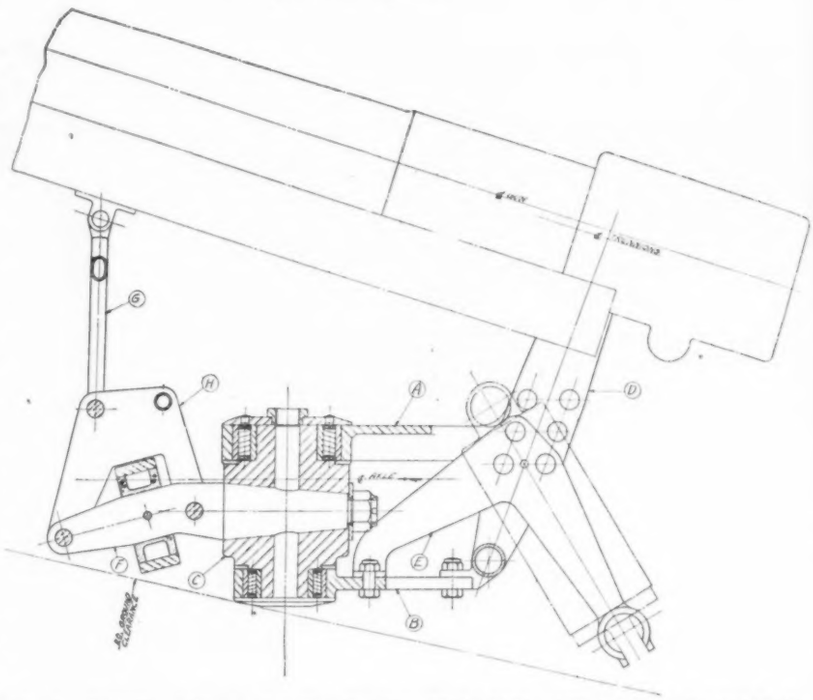


Fig. 1. Diagram of 75-mm. Gun Top Carriage, Model 1923, as Modified for Greater Road Clearance

ARTILLERY DIVISION

75-mm. Gun Carriage, Model 1923E. Top Carriage

In the November-December 1922 issue of ARMY ORDNANCE (page 174) a description is given of the top carriage and pintle for the 75-mm. Gun Carriage, Model 1923E. As stated, a wooden model of this carriage was constructed. As a result of tests recently carried out with experimental carriages at Fort Bragg, it was decided that road clearances up to 20 inches were especially desirable. As a road clearance of approximately 14 inches was provided in this carriage, a new design was laid down with the view of increasing the clearance to 20 inches. The accompanying figure illustrates the changes in the top carriage, pintle, equalizing gear and equilibrator necessary to obtain this result.

As will be seen in Fig. 1, the top carriage base has been made into upper and lower halves, A and B, and both are bored out on a vertical line to contain the upper and lower Hyatt roller bearings which are seated on vertical annular surfaces turned on the axle C at the center. The vertical distance, center to center, of the bearings has not been changed from the original design. The top carriage body D is fastened to the two base halves and extends upward and backward to meet the cradle trunnions. A top carriage brace E is bolted to the lower base half and riveted to the upper half and top carriage body. It serves to brace the top carriage and also to provide a trunnioned support for the equilibrator cylinder. The equilizing gear has been rotated approximately 75 degrees forward, and is now supported by the equalizing fulcrum F, which has a tapered shank passing through a tapered hole in the axle and prevented from turning by a vertical pin. The center leg of the cradle lock G is fastened by a pin between the two fulcrum plates H and holds the gun and cradle in the position shown in traveling. The equilibrator cylinder has been shortened and 56-inch wheels substituted for 48-inch wheels in the original design. These changes have

brought the road clearance up to 20 inches without decreasing the strength of the top carriage and pintle and without materially affecting the stability of the carriage in firing or the lateral stability when traveling.

Lunette for 75-mm. Gun Carriage, Model 1897 (French)

The bail type lunette for the 75-mm. gun carriage, Model 1897 (French), was designed to enable the Fordson tractor to tow this weapon. The Fordson tractor used is modified by the addition of a track-laying adapter and an Ordnance pintle.

Fig. 2. **Modified Lunette for Fordson-drawn 75-mm. Gun Carriage, Model 1897 (French)**

On account of the tendency to overturn backward about the *c* of the rear axle, it is necessary that the *c* of the pintle be kept as low as possible. With the pintle located slightly below the *c* of the rear axle of the tractor and the standard carriage lunette attached to it, the point of the spade is too close to the ground. The bail type lunette is so located with reference to the standard lunette that the point of the spade rides about 12 inches higher than in the case of the standard carriage lunette. The bail type lunette as originally designed consists

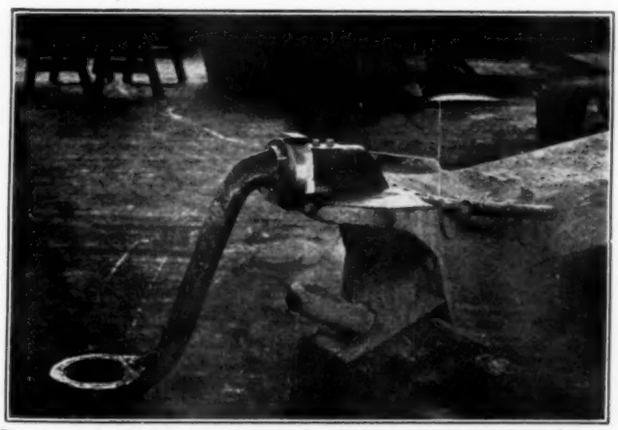


Fig. 3. **Combination Lunette and Handspike, Aberdeen Model 1923, for 75-mm. Gun Carriage, Model 1897**

of a "U"-shaped piece of 1½-inch round stock upset at the open ends to form bosses for boring 1-inch holes to receive the hinge pin. About 5½ inches from the closed end bosses are formed on the upper side of the lunette. These bosses are bored and slotted to receive a ¾-inch locking pin. The locking pin is retained by a projecting pin near its end. When locking pin is inserted, the projecting pin passes through the slots previously referred to. When the handle is turned 180°, the pin cannot be withdrawn. The lunette is secured to the carriage trail by two brackets which fit over lugs on the upper ends of the spade point and are fastened thereto by existing bolts. The hinge pin is held in place by the sides of the trail flasks.

Operation.—In firing position, the lunette is swung to the front to a position within the trail flask. In traveling position, the lunette is swung rearward and upward until it comes in contact with the lower edges of the spade point. The locking pin is then inserted and turned through an angle of approximately 180° and held in this position by a bolt snap attached to a hole in the handle of the pin. The bolt snap is attached to the lunette by a short piece of chain and a chain rivet.

During the test of this lunette, the pintle jammed while making a sharp turn. It is believed this was due to the sides of the lunette nearest the spade point being straight lines and approximately perpendicular to the face of the spade. To overcome this difficulty another design has been prepared, which provides a slightly longer lunette of the same general type but having a ring of 4-inch inside diameter at the closed end. (Fig. 2.)

An alternate design, known as the combination lunette and hand spike was also tested. This lunette (Fig. 3) fits the socket for the standard carriage lunette and required no modification of the carriage except the addition of two 7/32-inch tapped holes on the top of the socket. The eye of this lunette is so located that the ground clearance under the point of the spade is approximately the same as with the bail type lunette. Tests indicate that the stock used was not heavy enough at the bend adjacent to the socket and the drawing has been revised to cover this defect in any future manufacture.

Operation.—In the traveling position, this lunette is turned downward, and in firing position, it is rotated through 180°, which raises the lunette approximately 30 inches. In the latter position, it serves as a hand spike for moving the trail. The lunette is held in either position by the locking collar. The collar is so fitted to the shank of the lunette that it prevents turning movement between the lunette and its socket when the collar is in the locked position. The lunette is released for turning from one position to the other by lifting the spring locking clip and moving the locking collar to the rear until the lugs on the collar are clear of the float. After the lunette is in the desired position, the locking collar is returned to the locked position and secured by the locking clip.

Professor Veblen on Ballistics in the World War

The removal of a little copper from the rotating band on a projectile during the World War not only increased its range by more than a mile, but increased its accuracy several times. Such a seemingly trivial thing as this, but with such extraordinary results, was accomplished by scientists during the war.

Oswald Veblen, Princeton University, one of the scientists attending the American Association for the Advancement of Science this week, broadcast this statement over the radio last night. His subject was "Ballistics Used During the War."

In a popular type of address, which was in striking contrast to the numerous technical addresses of the convention, Prof. Veblen said that when the World War began mathematicians rushed into military service with the same mixture of emotions and the same readiness to fall to at the first task available.

Confronted With Problem

A problem of great urgency they found awaiting them was this:

"If you aim a cannon with a given angle of elevation, for example, an angle of 50 degrees between the cannon and the horizontal, and fire a projectile with a given velocity of say 2,600 feet per second, and set the fuze so that the projectile will explode at the end of eight seconds, where will the projectile be when it explodes? This is a typical problem of ballistics and you must be able to solve it if you are going to have any hope of hitting an airplane when you shoot at it.

"The answer depends on a large number of conditions. The gravitational attraction of the earth draws the projectile downward and curves its path. The air resists its motion in a manner that changes as the speed of the projectile diminishes. The spinning of the projectile caused by the rifling of the gun induces the projectile to drift slightly toward the right or the left, according as the rifling is right hand or left hand. A wind blowing with a definite velocity will carry the projectile with it a certain amount. Even the rotation of the earth on its axis has a measurable effect in the case of very long ranges.

"It requires no argument to show that here is a problem with teeth in it.

Two Weeks' Work Required

"At the beginning of 1917 the best method known to our army required the work of a computer for two weeks to determine the course of a single shot of the sort I have described, and that computation would by no means take account of all the complications.

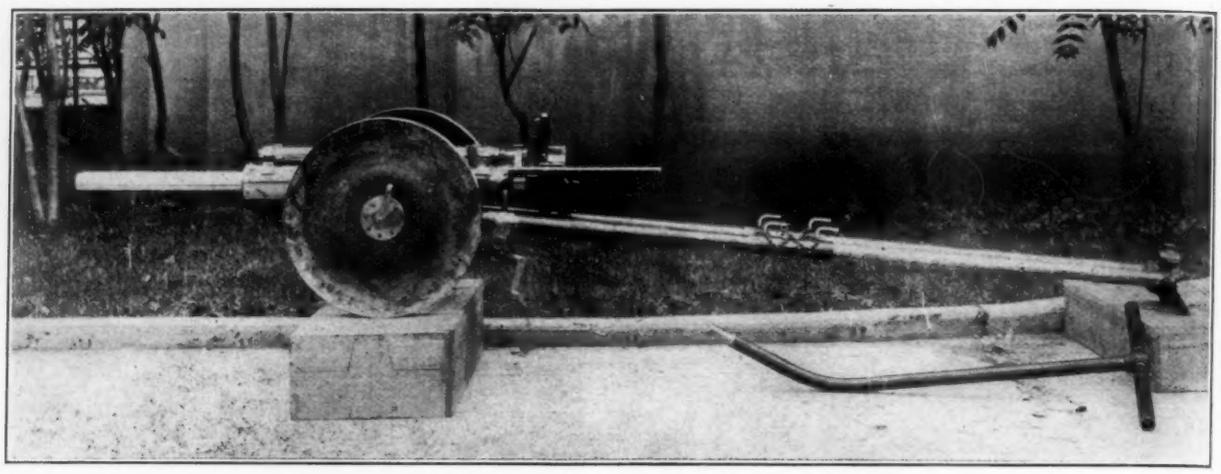


Fig. 4. 37-mm. Gun Carriage, Model 1923E, left side, with Trail Extended

"This was a situation to annoy any mathematician, for mathematicians hate computing. Years ago, when I used to play bridge, my friends never allowed me to add up a score. This was not because they doubted my honesty, but because they could do it quicker and better than I could.

"Well, the motion of a projectile is in principle not unlike that of a planet traveling around the sun, and the army has secured the services of Prof. Moulton, the mathematical astronomer of Chicago. Prof. Moulton rejected the cumbersome method that had been in use and turned to a method of the type that is successful in astronomy. The result was that the computation which had previously required a couple of weeks could now be done in a few hours.

"This achievement was, of course, a great deal more complicated than it sounds, particularly the problem of allowing for the varying effects of the wind and weather. In working these matters out further important contributions were made not only by Prof. Moulton, but also by another Chicago mathematician, Prof. Bliss, and also by Dr. Gronwall, of New York.

Had to Fire Big Guns

"But the work of mathematicians was by no means all of this theoretical sort. All theory must be based on experiment. And the experiments in this case consisted in getting out and firing the guns in all sorts of conditions. This was done first at Sandy Hook and afterward at a place in Maryland called Aberdeen. In practice it was a story of mud and mules, and occasionally a cannon exploding before the high explosive projectile had left it.

"Here we had scientifically trained men engaged on what looked at first like the crudest sort of rough work. But while doing their routine work these men were watching their material and making experiments with a view to improving it. The results in many cases were very valuable. In one case they were extraordinary. For by a very slight modification—cutting off a little copper from the rotating band—the range of the projectile was increased by over a mile and its accuracy made several times as great. This was a work of collaboration in a very real sense, but the main credit should go to a young graduate of the Massachusetts Institute of Technology, Philip Alger.

"This is all ancient history now. The chief actors are all interested in other things. But there is a moral to the story which should be stated even though it be obvious. No country can do without its men of science, and by this I mean not merely men who know things, but men who are in the habit of finding things out—research men.

Research Men Needed

"It was very noticeable that the men who were of the most use were the men of the active research type. The reason that the mathematicians could deal with the problems I have been talking about, and many others, was that we have a large group of men who are continually making new discoveries in the higher mathematics. And I must say that, to me, these discoveries are much more exciting and interesting than any of the war problems that I was asked to talk to you about.—From: The *Cincinnati Enquirer*, Dec. 30, 1923.

ROCK ISLAND ARSENAL

37-mm. Gun Carriage, Model 1923E, and Infantry Limber and Caisson, Model 1923

The 37-mm. gun carriage, Model 1923E, and the infantry limber and caisson, Model 1923, have been completed. The 37-mm. Gun Carriage, Model 1923E, was described in ARMY ORDNANCE for Nov.-Dec., 1922 (Vol. III, No. 15, p. 154). Several changes have been made, however, the most noticeable of which is the use of disc wheels. As it is essential that this carriage be easily maneuvered in brush and mud, the disc wheel is thought to be more promising than a light wheel of

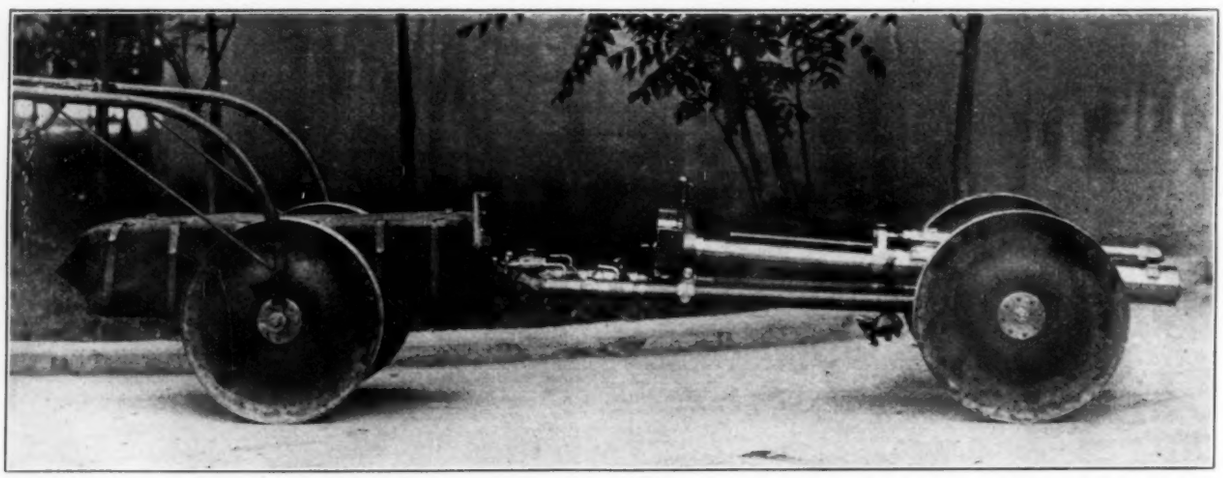


Fig. 5. 37-mm. Gun Carriage, Model 1923-E, with Infantry Limber and Caisson, Model 1923E

the artillery type. The increased weight, due to the use of the disc wheels, permitted the gun to be shortened two inches. The elevating mechanism was changed so that it now consists of a hand crank and shaft, a set of bevel gears, and the elevating screw and nut, all located on the left side of the carriage. A traveling lock has been provided so that the gun can be retracted and locked securely in place when traveling. The total weight of the pilot mount is 354 pounds. Fig. 4 shows the carriage in firing position. When the location of the carriage is such that the use of a long trail is impracticable the trail may be shortened by telescoping.

The Infantry Limber and Caisson, Model 1923, has been

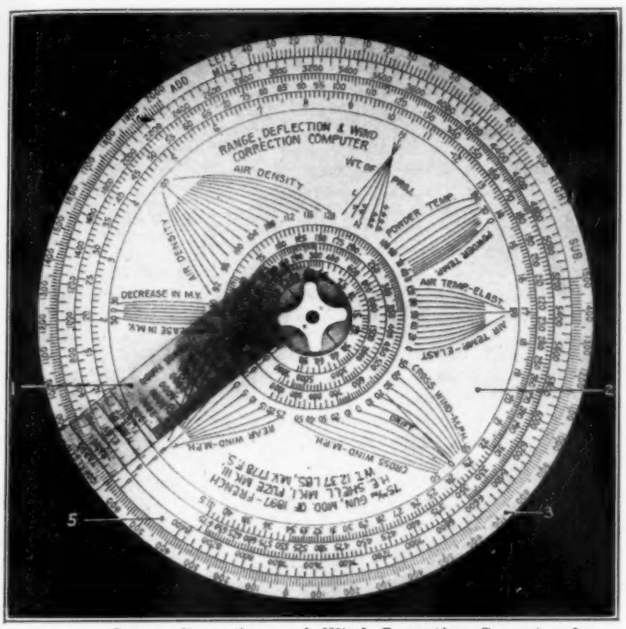


Fig. 6. Range, Deflection, and Wind Correction Computer for 75-mm. Gun, Model 1897

designed and manufactured for the use of the infantry in transporting ammunition. This combination limber and caisson is to be drawn either by one animal or by man power. A pintle is provided so that either the 37-mm. gun carriage or the infantry mortar may be attached to it, or so that several limbers can be hooked together and drawn by one animal. The weight of the infantry limber and caisson complete is 215 pounds, and the load to be carried by it is approximately 300 pounds. The disc wheels are interchangeable with the wheels of the 37-mm. gun carriage mentioned above or with the wheels of the infantry mortars. The 37-mm. Gun Carriage, Model 1923, and the Infantry Limber and Caisson, Model 1923, in traveling position, are shown in Fig. 5.

Ordnance Investigations at Bureau of Standards

The Division of Metallurgy of the Bureau of Standards is carrying on several investigations on Ordnance problems, the work being financed by a special allotment from the War Department. As illustrations of the type of work being done at the Bureau, the following investigations may be of interest:

Erosion of Steels for Machine Gun Barrels

In cooperation with the Ordnance Department and manufacturers of fire arms twenty-five special alloy steels were suggested by the Bureau for investigation of their suitability as machine-gun barrels. These steels were prepared and those physical properties which are recognized as essential to the life of machine gun thoroughly investigated. One of the arsenals assisted in making the steels into gun barrels, which have been put through a series of physical and ballistic tests. The interpretation of the data, such as targeting, measurement of bullet velocities, etc., as well as the determination of the effects of firings upon the metal was carried out at the Bureau. The results of the tests to date have suggested that several of the steels may prove to be superior to the type of steel now used. In connection with this work attention has also been given to the principal factors which affect the service life of a machine gun, as discussed in Bureau of Standards Technologic Paper 191.

Development of Light Armor Plate

The Ordnance Department has recently found that by making a few changes in the sequence of operations in the manufacture of light armor plate, a plate was obtained which has decided advantages over the plate prepared in the usual way. Most manufacturers do not regard with favor a manufacturing procedure which differs very much from what has become standardized by usage. At the request of the Ordnance Department the Bureau of Standards took up the investigation of this new method and undertook the solution of the problem of developing light armor plate and of preparing specifications expressing in physical terms those properties which are essential to the service of such plates which at present are expressed in ballistic terms. Work on the correlation of ballistic properties with physical properties has been outlined with the purpose in view of determining the properties possessed by a successful plate. Experimental data are being collected from the separate research units which have been assisted in the work, in addition to the Bureau and the results are being condensed and incorporated into tentative specifications.

A part of an investigation has been completed on the manufacture and properties of steel plate for light armor. It originated from the need of the Ordnance Department of the Army and the Bureau of Ordnance of the Navy for information regarding the effect on the ballistic properties of light armor plate of certain chemical elements. An earlier investigation on light armor plate was carried out in cooperation with the Bureau of Mines and the Navy Department. The metallurgical features have been discussed in Bureau of Standards Technologic Paper 207.

Miscellaneous Problems

A study was made of a number of different types of armor-piercing bullet cores. This problem involved the study of several steels differing in composition. A number of heat treatments were applied to each steel and tests made of those physical properties which are most desirable in armor-piercing bullet cores.

There are several other small ordnance items on which a considerable amount of work has also been done, such as the correlation of the characteristic features of fractures of tensile specimens of gun steels with the common mechanical properties of the steel.

The general subject of copper crusher cylinders such as are used in the testing of powder and ammunition also has received attention. The results of the investigation have been summarized in Technologic Paper 185.

Experiments have been completed on electroplating carried out with the view to determine the possibility of relining worn barrels by producing a coating of metal on the bore of the machine gun barrel which would be sufficiently adherent to withstand subsequent machining and rifling. Investigations were also carried out on the possibility of impregnating a steel surface with a refractory element suitable for resisting corrosion.

The study of gage steels which is now being conducted by the Bureau, although not solely an Ordnance problem, is of vital military importance and interest. The investigation is concerned with the proper methods of heat treatment of such steels as appear to be suitable for gage manufacture to insure maximum hardness with greatest permanence of form and dimensions in service or storage. The work has been planned and carried out in close cooperation with the Gage Steel Committee consisting jointly of representatives of the gage industry and of the Government. Frequent progress reports which are available to any interested parties are issued describing the work. The investigation is still in progress.

FRANKFORD ARSENAL

Range, Deflection and Wind Correction Computer

The computer shown in Figs. 6 and 7 consists of four members; the range arm (1), the correction curve disc (2), the correction and wind rose disc (3) and the grid or component indicator (4). (Figs. 6 and 7.)

The computer as shown was constructed for use with the 75-mm. gun Mod. of 1897 (French) firing H. E. shell MK-I with fuze MK-III.

The range arm (1) contains graduations representing range from 1,000 to 9,000 yards, also notations serving as a key to the range table data on disc (2).

The correction curve disc (2) contains correction curves for

muzzle velocity, air density, weight of projectile, powder temperature, air temperature, elasticity, combination drift and cross wind, and rear and head wind.

The three circumferential scales at the center and the inner two of the outer group are range table data plotted against the range scale (5) and serve as a graphical range table.

The correction and wind rose disc (3) lies between the discs (2) and (4). The outer long scale, Fig. 5, represents range

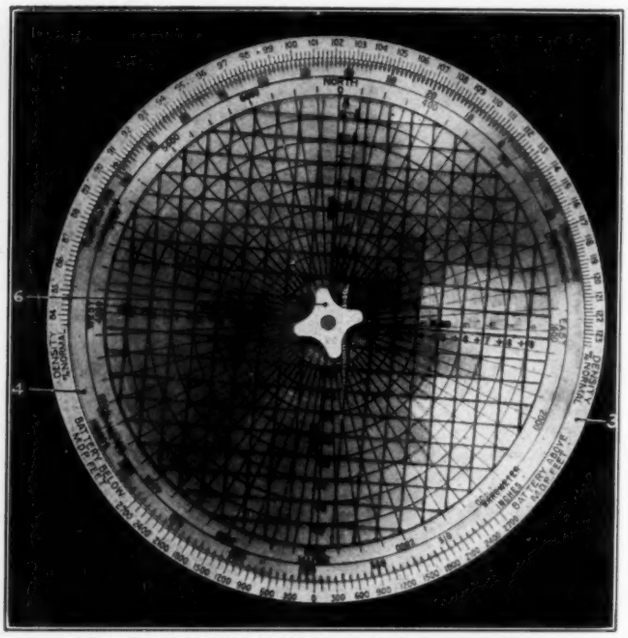


Fig. 7. Reverse Side of Computer Showing Wind Component Indicator

corrections and the shorter one drift corrections, used in connection with the combination drift and cross wind curves on disc (2). The under side of the disc, Fig. 6, contains the wind rose and scales representing air density and height of the battery and is used in conjunction with the temperature and barometer scales on the disc (4) for computing air density used in determining range corrections. See disc (2).

The grid or component indicator (4) is of transparent celluloid, and contains the grid for ascertaining the drift correction for cross wind and range correction for rear or head wind. The temperature and the barometer scales on its outer edge are used in conjunction with the height of battery and the air density scales on disc (3).

The thumb nuts (6) are provided for disassembling the discs, for inserting the desired correction curve disc (4) which is constructed to suit a particular gun and ammunition.

The computer is eight inches in diameter, and a heavy canvas pouch is provided for carrying it and the additional discs issued.

Bethlehem Steel Retains Emergency Ordnance Plants

The Bethlehem Steel Corporation, which devoted all its efforts during the war to the production of munitions and other ordnance materials, and which prior to the war was the largest producer of ordnance materials in this country, has rearranged its entire production schedule to strictly commercial steel products, according to a statement issued yesterday. This, however, does not include the emergency ordnance plants, which represent only about 2 per cent of its entire property and plant investment.

The cessation of hostilities in 1918 did not affect most other steel companies like the Bethlehem Steel Corporation, which made a specialty of ordnance work, and the Midvale Steel and Ordnance Company, which was absorbed by Bethlehem Steel last year. But huge as was the output of war materials by both companies during the war years, officials of the company take pride in the readjustment to a peace time basis, which was carried out smoothly and without great loss.

The United States Steel Corporation did not go into ordnance production on a heavy scale. This company's heavy output of steel was used to no small extent in connection with war work, but virtually no munitions or other ordnance products were turned out. The company had intentions of producing such materials at a new plant at Neville Island, near Pittsburgh, but the war ended before the plant was completed, and it has since been utilized along other lines.

The Republic Iron and Steel Company produced ordnance steel during the war, but not on a large scale, as none of its plants were erected for the purpose of specializing in this kind of work.

The statement issued by the Bethlehem Steel Corporation contains some interesting figures showing that the plants used for ordnance work during the war are now being utilized for manufacturing strictly commercial products, and says that the company has literally turned from the manufacture of guns to plowshares.

"The actual conversion of the company's ordnance manufacturing facilities from war to peace conditions," the statement says, "is well illustrated by a comparison of the October, 1918, production of three typical ordnance shops with the production of the same shops in 1923.

"It is notable that whereas in 1918 the material produced was made up largely of large numbers of articles exactly alike, the present production includes thousands of different articles. In the No. 1 projectile shop the production in 1918 was of machined shells, all practically alike, while now the production of that shop includes milling cutters, punches, jigs, rivet sets, gauges, and the better grade of highly finished machine shop products.

"The policy of the company is to produce an ever more diversified line of products—to the end that falling off of demand in one line will be compensated by capacity in other lines."—*From: The New York Times, January 4, 1924.*

No Profiteering War

The plans for industrial preparedness for war as described at the banquet of the ARMY ORDNANCE ASSOCIATION offer a better guarantee against any breach of the peace than all the efforts of the various peace societies. According to the organization, as sketched by the Assistant Secretary of War, Mr. Davis, there will, in the industrial world, be no slackers and no profiteers. It is today nobody's interest to bring about a war in order to realize huge profits. The sacrifice demanded by the civilian manufacturer is equal to that asked of the soldier under arms.

The farmer, the laborer, the merchant, the manufacturer must play their part in the common defense. Every man and woman, every factory, every natural resource, every science will have its place, each working for all and all for each. The organization of this industrial mobilization has been going on for three years past. The needs of the nation in time of war have been estimated by the seven supply branches of the government. The problem of their supply involves a survey of the industrial resources of the country, which is now being carried out. The country has been divided into fourteen procurement districts and many prominent business men have been asked to serve as branch district chiefs.

The United States has 17,000,000 men of military age, so that it would be possible to raise here the most formidable army the world has ever seen. The progress in the technical devices of war is going on steadily so as to equip this army with the very latest arms and war material.

In the last period of the world war the aggregate ordnance effort of the belligerents was consuming every month labor and raw material equal to the entire cost of the Panama Canal. Expressed in terms of cost, the total ordnance effort was equivalent to building New York city once a year.—(*From: The Washington (D. C.) Post, February 9, 1924.*)

Book Reviews

The Genesis of the War. By Right Honorable Herbert Henry Asquith, British Prime Minister 1908-1916. George H. Doran Company, New York. 32 chapters, 6 appendices, 405 pages. Price, $6.00.

Perhaps no man is better qualified to give to the world a resume of the events leading up to the World War than Mr. Asquith. In the days prior to the war there is no doubt that Great Britain carried a prestige on the European continent which was second to none. Around her evolved all the principal problems of the eastern hemisphere. Having been associated with the British Government for many years, Mr. Asquith became Prime Minister in 1908, and for six years before the war and more than two years after was the leading figure in the British Government and therefore had the opportunity to see things from the inside as they occurred. He has now seen fit to give to the world his impressions during this period and whether or not the world accepts them there can be no denying the fact that he has contributed a valuable addition to history.

As the title indicates no attempt is made to cover the events after the declaration of war. Only the years leading up to the final decision of Great Britain to enter the conflict, are discussed. This discussion is in no sense an autobiography nor does the author inject his own personality into the subject matter except in a very limited way. The purpose of the book may be said to be to trace the war to its origin. Many disclosures are made for the first time of so-called "secret" papers. Though criticism may be aroused by these disclosures it is the opinion of the author, after careful consideration, that they can now be of no detriment to the State.

Considerable space is devoted to the German charge of "encirclement" to which Mr. Asquith replies with an absolute denial and labels the charge a "legend." Documents supporting his statements are fully given and form an important part of the book. This should not be interpreted to mean that objection is taken to all things German for such is not the case. His praise of certain German statesmen is unstinted, notably of Baron Von Marschall, who at one time was Foreign Secretary at Berlin and who died in 1912 while serving as Ambassador at London. Of him he says, "I am satisfied as any one can be of any thing in the domain of conjecture that if he had remained there would have been no European war in 1914." His untimely death was to Asquith an international calamity.

The race of navies about which there has been so much written is fully discussed. The growing fear of German domination of Europe, to be accomplished through the defeat of the British Navy, is set forth as one of the chief causes for unrest in British political circles. A full defense of the British pre-war policy, as it was developed and rounded into shape is given.

A brief discussion of British relations with the United States is also included. The work of Mr. Page and Col. House is mentioned many times and both are lauded for their splendid service. A very interesting account of the mission of Col. House to Germany in May, 1914, for the purpose of promoting a sympathetic understanding between England, Germany and America, is given. As important as this mission was, very little has been made public and for this reason the author's remarks are especially interesting to Americans.

The book concludes with three chapters on the German Kaiser in which direct issue is taken with the accuracy of the latter's statements in his recently published book, "My Memoirs 1878-1918." In the Kaiser he recognizes natural endowments which might have led him far, had they not been wasted in wayward ambition and uncontrolled temperament. Indeed to counter-act the statements in the Kaiser's "Memoirs" appears to be one of the author's prime objects in bringing forth this book.

International Commercial Policies. By George M. Fiske and Paul S. Pierce. The MacMillan Company, New York. A text book of the Social Science Series, edited by Richard T. Ely. Price $2.25.

This volume should not be set aside as a text book and therefore not of interest to the general public. It is both valuable and interesting.

The book traces the development of commerce from ancient times to the present day and sketches the relationship of commerce to the political development of the various countries. With the modern period came the use of mercantilism, then of free trade, recently of protection, and possibly of a new policy in the past war period of kalaidoscopic change.

The beginnings of modern commerce in the mercantile period are of interest especially in the over-estimation of the importance of money and the lack of understanding as to what constitutes wealth. These ideas still persist in discussions of "favorable balance of trade."

The political and economic reaction as expressed by Locke, Voltaire, Rousseau and Adam Smith carried England and Europe from the restrictions of mercantilism to the spirit of individualism and non-interference in trade and industry—free trade. Under this policy the remarkable commerce of the British Isles has been built up.

The growth of nationality during the past century, the desire of nations to retain commercial advantages secured as a result of war and to become self-sufficient in war has resulted in a partial return to mercantilism in the policy of protection and restricted commerce.

This volume traces the development of tariffs and the purposes and results of tariffs in the development of commercial policy. It describes duties—both import and export—bounties, reciprocity, commercial treaties, tariff systems and institutions, and related terms. The book also discusses the departments, bureaus, agencies, and institutions of the National Government and their functions in the development of commerce and the promotion of trade and navigation. It also describes the function and organization of some of the semi-public and private institutions for similar purposes.

The part of the volume devoted to semi-public and public institutions is excellent. Our National Government has become so complex and exercises supervision, control or paternal interest over such a wide field that the public is confused and bewildered. The authors have filled a public need in presenting a simple, understandable picture of the activities of our Government in exercising these functions.

The book covers a broad subject in a small space. It is not obscure or obtuse. It is not opinion or propaganda but fact. It is written in a simple, direct, readable style. If you are engaged in business, trade, or industry, it will be worth your while to read it. If you are a lawmaker, by all means digest it; it will give us confidence in you. If you are a student, the text will furnish a foundation upon which to build; the excellent bibliography for each subject and the references and general bibliography will save you time in pursuing your studies. If you are just a plain ordinary citizen read it and compare with it the views of our lawmakers and publicists today. We thank the authors and the publishers for a job well done.

Memories Wise and Otherwise. By Sir Henry Robinson, Bart, K. C. B. Published by Dodd, Mead and Company, New York. 348 pages. Price, $4.00.

There are volumes and volumes that make a studied attempt to portray the Irish character. Some do justice to it, others villify it, still others take the middle of the road viewpoint and praise at one turn and damn at another. So unique a complex as the Irish possibly deserves some of each! At any rate much has been said on the subject. The pity is that not

all authors have been scrupulous about their own qualifications before embarking upon their task.

Sir Henry Robinson, with forty years of intimate contact with this very fascinating race, has had opportunities unequaled by few men of the recent past to study his topic. Sir Henry was a member of the Local Government Board in Ireland from 1898 to 1922. He lived in the Emerald Isle during what has proved to be her most crucial period thus far. Obviously, then, he is admirably equipped to handle his subject.

His style is marked by that freedom and, albeit, bluntness of expression that characterizes the British man of letters. He tells of his experiences—with the great lords and ladies of empire, with the simple unaffected clergy and laity of the "auld sod"—in a pleasant enjoyable manner that compels interest and provokes enjoyment. The entire book runs along in a free, candid manner that is at once captivating and convincing.

If you like historical narrative read this book for its style and its facts; if you are interested in the trials and tribulations of the new free state while it was in the making **read this authentic account. If you want to know some of the great of Great Britain during the past half-century follow** Sir Henry. He will introduce you to John Morley, the Balfours, James Bryce, King Edward, and the rest—all come in for delightful picturizations. Mr. Asquith and Lord French you will get to know a great deal more intimately than most books can possibly describe. The Sinn Fein, the Black and Tans and all the unfortunate happenings of a few years ago are told by a man who was on the scene and who viewed them with the broad vision of the trained English diplomatist.

In days to come, as Ireland makes her eventful entry into "her place among the nations" and her full history is written, this book of Sir Henry must always be regarded as a masterful account of a stirring story, well told and well worthy of praise.

Race and National Solidarity. By Charles Conant Josey. Published by Charles Scribner's Sons, New York City. 6 chapters, 227 pages. Price, $2.50.

From time to time books appear in which the line of reasoning and conclusions are contrary to the prevailing trend of public opinion. Such a book is "Race and National Solidarity." The author begins the introduction of his book with the following statement: "The rapid disintegration of civilization in Europe since the war must be a cause of serious alarm to all who are interested in the good of mankind." Unless one is able to accept this premise a full agreement with the conclusions drawn is impossible. In other words, those who believe that the present unrest in the world today is more in the nature of a chemicalization out of which will arise a purer and better democracy will find no support.

In all it may be said to attempt to point out the defects of present day idealism, that idealism which attempts to wipe out all race, color, or intellectual distinctions. The grand brotherhood of mankind, about which we hear so much and which was the incentive for the successful termination of the war, is pictured as full of defects, and a warning sounded lest we accept it to our future destruction.

Acknowledgement is made of the present day superiority of the white race or "group." The author believes this superiority should be and can be best sustained by nationalism rather than internationalism. Encouragement of self preservation is the key note of all argument, not from a selfish viewpoint but from the viewpoint that in this way the greatest sum total of good can be accomplished. Should the white race give over all its advantages to the colored races it is argued that in time the colored races, due to their superiority in numbers, will destroy the white race. It is, therefore, essential for the white race to hold itself together as a gruop lest it destroy itself.

The author's arguments are well sustained. There is plenty of sound reasoning which commands the respect of any thinker. New fields of thought are opened but it is extremely doubtful if the arguments will be found convincing.

History of Greek Philosophy—Thales to Democritus. By B. A. G. Fuller, Ph. D. Published by Henry Holt and Company, New York. XII plus 290 pages. Price, $3.50.

Professor Fuller presents in this volume the first stage of what augurs to be a monumental work on the history of Greek philosophy. We understand that other volumes will follow this one and that the series will include Plato, Aristole, and subsequent history. The volume in hand covers the period from Thales to Democritus.

With this larger work in mind one can forgive much in the first portion of the book which is at times prosaic. Now and then one gets a little peevish in following the author through a tedious treatise on the fundamental concepts of the Greeks and a somewhat academic discussion of philosophy itself.

But as one reads along a reaction of interest sets in and one begins to cancel those first impressions. Professor Fuller writes in a very human and unaffected style and his broad view of his subject gradually grips the reader and the old collegiate fire of the Greek gods comes back and one lives again in the atmosphere of Olympus.

It would be well if many of those who have labored over the Greek authors in their youth, and who, like this reviewer, have not given any considerable time to the subject since, could take up this volume and see their early notions crystallize into the definite notions of the Greeks, their religion and their philosophy, as Professor Fuller presents them. Such an experience would certainly revive a spark of admiration that early study long ago enkindled but which, because there was not the scintilating charm of this book nearby, has remained dormant ever since.

We can not help but feel that Professor Fuller has begun his history with a most creditable volume. Beginning with Miletus, through the Pythagorian period, then the Eliatic School, and concluding with the Pluarlists, this work with its exhaustive bibliography and its complete chronological table is something in which author and publisher should have just pride. Professor Fuller's coterie of listeners has expanded from the privileged few who sat at his feet at Harvard and will, no doubt, now include a larger following who will be eager to read his analyses in the remaining works he has in contemplation.

An Advanced Laboratory Manual of Organic Chemistry. By Michael Heidelberger, B.S., A.M., Ph.D., Associate in Chemistry, Rockefeller Institute for Medical Research. Published by The Chemical Catalogue Company, New York, N. Y. 1923. Price, $2.00.

Dr. Heidelberger has produced in this neat little volume a very valuable aid to the student of advanced organic chemistry. Obviously, any work which tends to make straight the labyrinth of the difficult laboratory practice peculiar to this subject is a boon in the hands of both student and instructor; but when this attribute is joined with a logical presentment of experiments that are "workable," as is done in this book, then we say it is a valuable aid to those making advanced study.

From a cursory reading of the experiments it seems that some may be rather difficult to perform. However, the author says he has avoided "preparations of so difficult or involved a nature as to become a source of discouragement rather than a stimulus to the student." Portions of the work are devoted to the formation of heterocycles and dyes; oxiadation, reduction, and the preparations and reactions of organometallic compounds. It would seem that there should be an eager reception of Dr. Heidelberger's manual among students of advanced organic chemistry.

Dyes Classified by Intermediates. By Norris Shreve, Consulting Chemist. Published by The Chemical Catalogue Company, Inc., New York. 1923. Price, $10.00.

In this exceedingly well arranged and thorough work the author has gone far to fulfill his aims as outlined in his preface, viz:

(1) To make available tables showing the commercial dyes derived from each important intermediate.

(2) To compile a logical tabulation showing the uses of any intermediate so that the needs of manufacturers, research chemists, and students in this regard may be served.

(3) To help the merchant in the buying and selling of dyes and intermediates by giving in the tables the various outlets and poundage of dyes and intermediates imported and manufactured.

(4) To prepare a glossary of names, with Schultz numbers, both of dyes and intermediates.

This is a valuable book for which both author and publishers deserve the thanks of all whose daily activities in the world of intermediates require such a logical and complete source of reference.

Industrial Filtration. By Arthur Wright, M. E. Published by The Chemical Catalogue Company, New York. 1923. Price, $5.00.

One cannot attempt to review this book without first saying a word for the publishers. As a general rule, the publisher comes in at the end, if at all, after the theory of the author has been praised or condemned, according to the dyspeptic temperament of the reviewer. By reversing the usual order we do not mean to detract from the excellent work Mr. Wright has done in this volume. On the contrary, the praise we have for the publishers is equalled by our satisfaction with his portion of the work. This book is the first of a series to be known as the "Modern Library of Chemical Engineering." Another volume on "Theory and Practice of Evaporation," by A. L. Webre and C. S. Robinson, and one on "Fractional Distillation," by E. H. Leslie and E. M. Baker, are now in course of preparation. Other volumes on Drying, Transportation of Liquids, Mechanical Handling of Materials, Compression of Gases, Electric Heat, and Grinding and Pulverizing, will follow. The aim is to present a current literature for the instruction, guidance and future progress of the chemical engineering profession. "An effort will be made to drag forth facts and little tricks of the trade from their hiding places so that the current status of all the fundamental subdivisions of chemical engineering can be presented without reserve." That this is a service of great professional worth will be readily granted by all. The publishers whose public spirit and technical interest have made possible this contribution to the science and industry of chemistry should and undoubtedly will receive the thanks and active support of all.

Mr. Wright has made the first volume of this interesting series an excellent architype for the rest. In a smooth yet thorough manner he discusses his subject from three angles: the theory of filtration, the mechanics of filtration, and filter practice. The several functional processes are explained under the first group, while in the second the various kinds and makes of commercial filters are described and commented upon. Rules and suggestions as to good practice complete the work. There is a wealth of information well illustrated and nicely presented in this book. Certainly this first volume augurs well for the remainder of the series.

Motor Fuels, Their Production and Technology. By Eugene H. Leslie, Ph.D., Associate Professor of Chemical Engineering, University of Michigan. Published by The Chemical Catalogue Company, Inc., New York. 1923. Price, $7.00.

The author's treatment of his subject is very complete and includes many references to other works on related subjects. The book is written in such a manner that it is of interest to both the engineer directly concerned with the production of motor fuels, and at the same time sufficient information of a general nature is given to be useful to those who know little of the refining industry and who do not care to go into the technical details, but who do desire to obtain a general idea of the motor fuel refining industry. Organizations or individuals interested in this subject will find in this volume a valuable addition to their reference libraries. The book in its seventeen chapters contains ample and enlightening discussion on the following subjects:

The motor fuel problem; the composition of petroleums; general outline of the manufacture of petroleum products; fractional distillation; fluid flow and heat transfer; refinery equipment for distilling petroleum; towers, dephlegmators, steam stills, condensers, heat exchangers, coolers and other refinery equipment; the thermal reactions of hydro-carbons; cracking processes; the chemical treatment of gasoline; natural gas gasoline; alcohol—a motor fuel of the future; composite and miscellaneous motor fuels; gasoline specifications and quality; distillation in the laboratory; methods of analysis; useful physical data and tables. A complete index alphabetically arranged is included.

Chicago Post, Army Ordnance Association, Established

The Chicago Post of the Army Ordnance Association was established on January 22, 1924. A meeting for this purpose was held at the University Club of Chicago, where dinner was served. Previous to the meeting a petition had been circulated and thirty-eight (38) signatures secured. The invitation list consisted of these thirty-eight signatures and the membership of the Chicago District Ordnance Association.

Shortly after the reestablishment of the Chicago District Ordnance Office the need of assistance from reserve officers and other interested persons in the conduct of district investigations was felt, and the Chicago District Ordnance Association was formed. It soon became evident that a closer relation with the national Army Ordnance Association was necessary, in order that local problems would be more readily coordinated with the local problems of all other districts for the solving of national problems, and it was finally decided to form a larger association to include all members of Army Ordnance within the Chicago Ordnance District and vicinity. At a meeting of the Executive and Program Committees of the Chicago District Ordnance Association plans were perfected to comply with the resolutions concerning local posts adopted by a Board of Directors of the Army Ordnance Association on January 11, 1923, the accomplishment of which resulted in the organization meeting.

At this meeting Mr. E. A. Russell was elected temporary chairman and he then gave a brief resumè of the activities of the Chicago District Ordnance Association and the causes which lead to the desire for a local post of the Army Ordnance Association, through which the assistance of the parent body in administration and information on National affairs could be obtained. That an organization with such a broad scope of influence could better maintain contact with and keep informed on persons and firms that had been of assistance to the Ordnance Department in the past was apparent.

Major R. H. Somers of the Ordnance Department, secretary of the Army Ordnance Association, then discussed the causes leading to the creation of the Army Ordnance Association and the need for local posts. He stressed particularly the lesson from the World War, from which it was learned that a war of today is not a battle between armies but an engagement between the entire resources of the nations affected, and that the mobilization of unarmed troops was more readily affected in terms of time, than the mobilization of industry and science for the preparation of munitions.

The following officers were elected: Mr. E. A. Russell, President; Mr. E. J. Buffington, Vice President; Directors for two years: Colonel R. P. Lamont, Lieutenant-Colonel H. C. Bayless, Mr. W. W. Coleman; Directors for one year: Major F. A. Englehart, Lieutenant Colonel Froman Smith, Mr. J. J. Thomas.

Reserve Corps Notes

Two training courses for reserve officers of the B. A. Group will be held during May. A fifteen-day active duty period will be held at Rock Island Arsenal from May 12th to 24th, inclusive, for officers of the Saint Louis, Chicago, Detroit, Cleveland and Cincinnati Ordnance Districts. A similar course will be given on the same dates at Frankford Arsenal for officers of the B. A. Group assigned to the Buffalo, Pittsburgh and New York Districts.

The lectures on the procurement of basic chemicals, by Lieutenant Colonel Fred H. Wagner, Ord-ORC, are being received with much enthusiasm by all officers to whom they have been sent. The second of the series, on "Fixed Nitrogen," is now in course of preparation and will be sent out shortly. These discussions, coming as they do from one of the best qualified engineers in the country, and being prepared with the needs of the reserve officer particularly in mind, fill a long-felt want in the instruction of reserve officers in the intricate and technical subjects of ordnance.

New Ordnance Reserve Officers

The following have accepted commissions in the Ordnance Officers' Reserve Corps since the last issue of ARMY ORDNANCE:

Colonel: Henry A. O'Dell.

Majors: Frank O. Behounek, Henry B. Faber, Joseph W. Henesey, Francis W. Taylor, Reuben S. Tour.

Captains: Anthony J. Bemis, Charles Gilmore, Francis L. Lindemuth, Walter J. Risley, Sr., Silas Williams, Frank C. Steward, Frederick H. Tyler.

First Lieutenants: William L. Allison, Joseph B. Bancroft, Hulbert D. Bassett, Ernest F. Bessette, Floyd M. Bevins, Tracy C. Kerr, Herbert L. McCaleb, Walter L. Maxson, Arthur J. May, Walter J. Merry, Rutherford Van Vliet.

Second Lieutenants: Ernest S. Atkinson, Carl V. Carlson, Harry P. Croft, Carroll A. Day, Alfred R. Fenzel, Michael P. Guida, Ernest W. Harwell, Robert G. Harkins, Paul E. Holcomb, Robert B. Kirkpatriek, Reynolds F. Kirkwood, Joseph E. McCaughey, Hugh F. Pierson, Hardy M. Ray, Charles W. Ruth, Jr., Andrew J. Schwartz, Mary A. Stephenson.

The following have recently accepted reappointments in the Ordnance Officers' Reserve Corps:

Majors: Howard E. Atterbury, Colin E. McRae, George W. Richey, Daniel Royse.

Captains: Joseph H. Batt, Edward M. Dulin, Camden Hogg, John F. Kruchten, Harry O. Mainzinger, John D. Wallace.

First Lieutenants: Perceval N. Anstey, Charles Biesel, James S. Carpenter, William A. Goss, Homer S. Rogers, Leonard F. Timberlake, Walter Van Pattensteiger, Stanley D. Willis.

Second Lieutenants: Henry Abrams, James N. Aken, Edwin H. Albrecht, Charles W. Apgar, Franklin M. Benson, Stanley P. Benton, Harold S. Christopher, George W. Cooke, John C. Dorward, Dann Faber, Thomas J. Gainer, Harry M. Hannemann, John M. Hawes, Samuel Henderson, Harry E. Hillstrom, Arthur H. Jones, Clarence A. Martin, Howard C. Nellis, Laurence G. Nourse, Bernard R. O'Connor, Edward S. Poole, Roy R. Rommel, Stewart R. Scott, Meyer Stone, Clarence D. Van Sickle.

An Ordnance Reserve Officer on Fifteen Days' Active Duty

By ROY S. HAGGARD, 1st Lieutenant, Ord-ORC

"In time of war the question of personnel is always the most vital factor * * *. *But responsibility in the matter of personnel can and should be shared with the O. R. C.* How best to effect this and make scientist and engineer reserve officers feel their responsibility * * *, is another matter; possibly it can be done through the pages of ARMY ORDNANCE and the journals of other branches of the service, to which reserve officers should be encouraged to contribute more frequently than heretofore."—(*Scientists and Engineers as Reserve Officers*, by Col. F. E. Wright, ARMY ORDNANCE, Vol. IV, No. 20, 1923.)

The article from which the above quotation was taken inspired this writing to the point of execution. Many inspirations are short lived. Of the few that come to fruition the following is thought to be typical. With the hope that other Ordnance reserve officers may be encouraged to assume their individual share of responsibility for maintaining to the full strength a high type of personnel this article is written for ARMY ORDNANCE.

Before being examined for a commission, very little information seemed available concerning the Reserve Corps. In fact, those to be examined went to the examination blind as to its scope. In this particular case it was not until after the examination that any marked enthusiasm manifested itself. A particularly fine statement of the aims and accomplishments of the O. R. C., made by the examining officer (Major C. H. Mason, U. S. A., in charge New Hampshire Contingent 97th Div., Organized Reserves) was responsible for this. In the course of the remarks it was stated that funds were available for reserve officers of the B. A. Group to be assigned for fifteen days' active duty at other than the summer training camps. Further, that it was possible to secure these special assignments if requests were made, stating the reasons for the request and indicating the time and place desired. When the writer's commission arrived on November 6, 1923, request was immediately made for fifteen days' active duty between the dates of December 15, 1923, and January 2, 1924, at Watertown Arsenal, or any other Ordnance establishments. Even though the time was short and the first request was refused, special orders came finally, a few days before the reporting date suggested in the original request. The orders were to report to the Commanding General, First

Corps Area, Boston, Mass., for a course of instruction in the office of the Corps Area Ordnance Officer.

Many think of the reserve officer as one who may be ordered to active duty at any time. Such is not the case. His consent is absolutely necessary before assignment to active duty in peace times. But even more important is the fact that the reserve officer must initiate the request. Therefore, a "watchful waiting" policy will not bring results. But why should any one desire active duty? Surely not for the purpose of wearing the uniform, or for social reasons, or for the compensation. Why then ask for DUTY when by keeping quiet no trouble will be experienced? Many go on the principle "don't trouble trouble until trouble troubles you." Then why trouble to get a commission, why trouble to get into the O. R. C.? Surely it is not worth while for the sole purpose, that some time there may be a war. The only reasonable answer to the above questions would seem to be service and self-improvement. If there is no desire to serve or to improve, the commission should be resigned. Col. Wright in his article treats this matter from the point of view, that the officer can keep informed along his special line by study and research; this article is written to show what one officer has accomplished in a slightly different way. It is not expected that any of that which follows will be of great military value, but it is hoped that certain reserve officers will find herein something to aid them in solving their problem and in securing a similar assignment to active duty for a fifteen-day training period.

In securing an assignment of this character the cooperation and assistance of the Regular Army officers at Division Headquarters of the Organized Reserve divisions is necessary. In this particular case very cordial consideration was obtained of the request.

An old maxim says, "if you can't get what you want, get what you can." Sometimes, of course, it is difficult to know what to want. Being unable, on account of business, to attend organized reserve training camps held during the summer, my application was made for whatever training could be obtained and for which funds were available. On investigation it was found possible to secure assignment for fifteen days with Col. E. P. O'Hern, Ordnance Officer, First Corps Area, Boston, Mass. This type of assignment is available, no doubt, in the other technical and staff branches, and in the other Corps Areas. In being introduced by Colonel O'Hern to various officers in the Corps Area, this assignment was mentioned as "pioneering"—somebody had started something. A pioneer is naturally subjected to criticism and the path to be followed is not always clear. This is equally true of the reserve officer as well as the branch to which he is assigned. But without any "fear or trembling" a workable plan can be evolved. It is certainly true that the initiative for training rests with the reserve officer, but it is equally true that the value of that training depends on the officer to whom he may be assigned for instruction in his particular line.

On reporting for duty the writer was plunged at once into work, and that is as it should be, for time was short. A program had been planned that fulfilled every available working hour. This was explained, and after introductions to officers of the headquarters and personnel of the office, the process of absorption was started.

The start was made in the Ordnance Office on requisitions, finance vouchers, procurement, correspondence and reports without going too much into details; just the outline, methods employed and the nomenclature, tools of the trade, so to speak. Several days were spent reading Field Service Bulletins, pamphlets and handbooks of the War and Ordnance Departments. In all of the above work no attempt was made to master any particular detail or phase of the Corps Area Ordnance Office. Rather importance was placed on general familiarity with all the functions and their inter-relation. After several days concentrated study in the office, nearby trips were made to cover special activities. Thus, one day was spent at Watertown Arsenal, another at Fort Banks (one of the coast defenses of Boston Harbor), and parts of other days at the Boston District Ordnance Office, and with the enlisted personnel on maintenance of tractor equipment and artillery.

The day at Watertown Arsenal was spent under the guidance of one of the technical executives and even though the plant is operated on a much smaller capacity than even before the war, still much that was interesting was found; the foundry and forging shops; the erecting shop where the largest coast defense guns are mounted; the various buildings given over to special work in time of war; the laboratories and administrative buildings, and the storage facilities and general layout of the grounds. Any reserve officer visiting such an establishment naturally would find some activities of particular interest on account of previous training and experience.

The writer's war activities were entirely with the Nitrate Division at Plant No. 1, Sheffield, Alabama (Muscle Shoals), and later at the Fixed Nitrogen Research Laboratory, Washington, D. C. His assignment at present is with the Manufacturing Division with station in an emergency, at Muscle Shoals. Plant No. 1 uses the Haber Process involving pressures of 1,500 pounds. At Watertown Arsenal the experimental work therefore particularly appealed to him. The aims in this case are not the same as with the Haber Process, but singularly, the difficulties experienced and the methods employed to overcome them were almost identical. Other matters of special interest were the testing laboratories including the 800,000-pound capacity testing machine and the X-ray laboratory where some wonderful research experiments on the X-ray of metals are being conducted. Many other items of interest could be mentioned; these are cited as being typical of what may be found at most of the Ordnance establishments. Mention, however, should be made of discussions or talks with various officers and heads of departments, in particular a long talk with the Executive Officer, Major Nickerson, who also has charge of the Ordnance School at Massachusetts Institute of Technology. It is very evident that any reserve officer would find something at an arsenal to aid him in a better understanding of his duties as an officer in a national emergency.

Some mention should also be made of the visit to the Coast Defenses of Boston. Few reserve officers ever see this phase of the Ordnance Department. The guns made at Watervliet Arsenal are sent to Watertown for mounting; and in forts such as these one sees these guns mounted and maintained by a corps of trained men under the direction of the Corps Area Ordnance Officer.

The part of a day spent at the Boston District Ordnance Office was inspirational to a high degree. The executive officer, Captain L. P. Crim, took great pains to explain this most important work of the War Department under the Assistant Secretary of War. Industrial mobilization in the next war will run side by side with man power mobilization and every reserve officer should familiarize himself with the general problems and aims of

this feature of the general problem of mobilization.

In the foregoing no attempt has been made to deal with any particular problem or to show the exact nature of the points studied, simply to give an idea of what may be studied in an area such as the First Corps Area presents. There is enough in every Corps Area for a reserve officer to study in fifteen days, in fact, more than

Reserve Officers at Rock Island Arsenal School of Instruction, November 12-24, 1923

Those in the picture from left to right are: (Standing) Second Lieutenant Walter G. Lawson, First Lieutenant Hollis S. Beatty, First Lieutenant Ernest E. Probyn, First Lieutenant Albert W. Heinrich, First Lieutenant James W. Fraser, and Second Lieutenant Richard Phillip Jones; (sitting) First Lieutenant Edward H. Boeckh, and Captain Leslie S. Solar.

can be fully grasped in so short a period. Nevertheless, a very broad outlook on the whole Ordnance problem can be obtained by studying the various activities and reading the literature in connection therewith. At all times, extreme cordiality was encountered and great interest shown in the reserve officer attempting to inform himself. Every effort was made to place at his disposal all the information at hand.

In conclusion, the writer wishes to commend to all reserve officers, who can find the time, such an assignment to active duty as that described in this brief account, as a practical method of keeping up with the activities with which he allied himself in accepting a commission as a reserve officer.

Rock Island Arsenal School of Instruction for District Ordnance Reserve Officers

The first school of instruction for Western District Ordnance Office Reserve Officer personnel was held at Rock Island Arsenal, Rock Island, Illinois, from November 12 to November 24, 1923.

The following reserve officers took the course: Captain Leslie S. Solar, of Chicago; First Lieutenants Hollis S. Beatty, of Chicago, Edward H. Boeckh, of Cincinnati, James W. Fraser, of Chicago, Albert W. Heinrich, of Cleveland, and Ernest E. Probyn, of Detroit; Second Lieutenants Richard Phillip Jones, of Cincinnati, and Walter G. Lawson, of Detroit.

These officers were quartered on the Arsenal grounds in the Hospital Annex and were charged only for the necessary laundry expenses. Meals were served by the 33rd Ordnance Company at fifty cents per day for each man.

The course of instruction consisted of study and discussion of the various lectures previously sent to all Ordnance reserve officers and practical instruction in the operation of a government arsenal. Among the lectures studied were: "The Ordnance Problem," by Major General C. C. Williams, Chief of Ordnance, and "War Time Procurement and Issue of Munitions," also by General Williams; "Industrial War Plans of the Ordnance Department," by General William S. Peirce, late Chief of Manufacture, Office of the Chief of Ordnance; and "Mass Procurement," by Colonel J. Mayhew Wainwright, former Assistant Secretary of War.

General Colden L'H. Ruggles, Chief of Manufacture, Office of the Chief of Ordnance, addressed the class on the subject of the design and manufacture of ordnance; and Colonel David M. King, Commanding Officer at Rock Island, read a paper on "The Development of Munitions."

Practical instruction in inspection and operation of the arsenal was given in the various shops, permitting the officers to observe and perform work in progress. All paper work in connection with finance, procurement, production, inspection, proof issue, storage, property accounting and personnel, both civil and military, was studied under working conditions, and, to complete the course, each officer was required to write a critical report to the Commanding Officer.

The officers who attended this school are very enthusiastic supporters of ordnance training, and they expressed a sincere appreciation of the efforts of the Arsenal personnel in making the course interesting.

The Factors of National Defense

"The character of warfare has been undergoing a gradual evolution from hand-to-hand combats, in which man power is the supreme factor, to modern warfare in which munition power is as important as man power. This evolution was not realized even by the great military powers at the outbreak of the World War, and its importance and significance are not grasped even yet by many military men. It is not enough in modern warfare to have an adequate number of men adequately trained. They must also be adequately equipped with all the offensive and defensive devices of science, if they are to have a fighting chance against a modern enemy. So the industrial, economic, and scientific resources of a country are a great potential factor of its military strength. In order to be available for the country's defense, these resources must be mobilized in case of war, just as the man power must be mobilized. Thus it is as necessary to plan for the mobilization of industry as of man power, particularly as time is an all-important factor in war. In fact, it is even more important to plan carefully the industrial mobilization, because the man power can be mobilized and trained much more rapidly than it can be supplied, equipped, and armed."—(*Assistant Secretary of War, Colonel Dwight F. Davis, before the Saint Louis Chamber of Commerce, January 24, 1924.*)

Recent Patents

Brief Descriptions of Inventions of Interest to Ordnance Engineers

Compiled by W. N. Roach, Chief, Patent Section, Office of the Chief of Ordnance

THE following is a summary of the recently issued patents which may be of interest to readers of ARMY ORDNANCE.

Ammunition

Patent No. 1,481,798, issued to John H. Hammond, Jr., and Henry F. Bushwell, discloses a projectile for emitting poisonous gases. The projectile is divided into a series of compartments containing substances adapted to react chemically and to produce a poisonous fluid, the substances being so arranged that they are mixed upon discharge of the projectile from a gun. Means are also provided for exploding the projectile at a predetermined time after striking an objective.

Charles H. Miller has been granted patent No. 1,481,872, covering a projectile which seems adapted more especially for use with small arms. This projectile or bullet contains its propelling charge so that the use of a cartridge shell or case is not necessary. The primer is arranged in an opening in the rear of the bullet and a rod, fast in the nose of the bullet, extends longitudinally with the bullet terminating near the primer to form an anvil. The bullet is chambered to receive the propelling charge.

Ernest M. Symmes, assignee to Hercules Powder Co., has secured patent No. 1,478,588 for an explosive. Mr. Symmes has substituted for cane sugar in explosives containing nitro sugar, mannose, preferably prepared by the hydrolysis of yeast gum; salep mucilage or other of the isolated mannose, or by direct hydrolysis of some plant material rich in mannan, such as ivory nuts, carob beans, coffee berries, date seeds, etc. The use of mannose in place of cane sugar, cheapens the product, and a large quantity of mannose can be dissolved in a given amount of glycerine and give a solution that is less viscous than the solution of cane sugar and glycerine.

A process for obtaining nitrogen from the air in the form of ammonium hydroxide is disclosed in patent No. 1,480,291, issued to Wilbur A. Nelson. A mixture of bentonite and gas carbon reduced to a plastic state by the addition of water is shaped to form balls or a cylindrical roll and placed in a non-electric furnace and heated to 1000°C. Heated air is drawn through the furnace from the beginning of the heating and until the temperature reaches its maximum, and the gases and air issuing from the furnace are passed through a condenser. Ammonium hydroxide is produced in continuous yield after a temperature of 460°C. has been reached.

A propellant powder formed from a nitrocellulose colloid and black powder paste intimately mixed is disclosed in 1,464,012, issued to Arthur S. O'Neil and Raymond R. Evans, assignors to Western Cartridge Company.

A detonator mixture in which, in place of fulminate of mercury, nitro-starch in granules of an average size in excess of .045 mm. is used, is covered by patent No. 1,462,093, issued to Charles E. Waller, assignor to Trojan Powder Company.

Patent No. 1,458,525 has been issued to Farrington Daniels and Oliver R. Wulf, formerly of the Fixed Nitrogen Research Laboratory, for a process for the fixation of atmospheric nitrogen by means of a special electrical discharge.

Small Arms

The following patents are of interest to those making a special study of small arms:

A magazine sear lock is shown in patent No. 1,466,749, issued to John D. Pedersen and Crawford C. Loomis, assignors to Remington Arms, Inc.

A reciprocable bolt mechanism for breech loading arms is covered by patent No. 1,476,029, issued to John D. Pedersen.

A special form of fire control mechanism for semi-automatic fire arms is covered by patent No. 1,473,571, issued to John D. Pedersen.

A special type of cartridge drum and feed mechanism for use with the Vickers machine gun is disclosed in patent No. 1,462,852, issued to A. T. Dawson, F. T. Buckham and Carl Larsson, assignors to Vickers, Ltd.

Means for manually retracting the barrel in a machine gun of the Vickers type to simplify the initial loading operation is disclosed in patent No. 1,468,262, also issued to A. T. Dawson, George T. Buckham and Carl Larsson.

A double barrel machine gun with recoiling barrels is disclosed in patent No. 1,477,115, issued to Carl Gast.

An automatic fire arm is covered by patent No. 1,475,-761, issued to George O. Fisher, assignor to B. M. Fisher.

A trigger mechanism for use on pistols or other fire arms is covered by patent No. 1,475,037, issued to Edward T. Thimgren.

An automatic fire arm is covered by patent No. 1,472,-126, issued to John T. Kewish, assignor of one-fourth to John C. Garand.

Means for facilitating the feeding of cartridges from magazine to chamber so as to obviate jams, to facilitate the filling of the magazine and also to facilitate the loading and removal of the magazine into and from the gun are covered by patent No. 1,464,864, issued to J. M. Browning.

A special form of cartridge magazine is disclosed in patent No. 1,462,972, issued to Isaac N. Lewis.

A safety device for automatic pistols and other small arms is shown in patent No. 1,461,387, issued to John W. Fearn.

A novel cartridge-feeding magazine for machine guns is covered by patent No. 1,460,880, issued to Millard L. Johnston.

Stanley Kaperzenski has been granted patent No. 1,478,568 on a combined sword and revolver. The sword is provided, near the hilt, with depending flanges providing a dove-tail groove into which a revolver may be slipped, the groove receiving the rib usually formed on the upper side of the barrel.

Samuel Wiley, an employe of the Ordnance Department, at Picatinny Arsenal, has been granted patent No. 1,479,122, on a combined fire arm and grenade discharger. The stock of the usual fire arm is formed with a barrel housed therein for the reception of a grenade and its propelling charge; a firing mechanism is provided in the stock for the grenade thrower. The butt plate of the stock is removable and attachable to the muzzle of the fire arm to act as a foot plate when the arm is used as a grenade thrower.

Patent No. 1,479,138 has been issued to George Hazelton, assignor to Vickers, Limited, covering a counter for indicating the number of rounds fired by a machine gun. In this instance a spring-pushed rod is made use of for operating the counter, the spring and rod being armed or cocked by a recoiling part of the gun, and operating the counter under the force of the spring upon counter recoil of the part.

Means for lengthening the sight base of a sight for fire arms, especially useful with pistols or revolvers, is disclosed in patent No. 1,480,048, assigned to Harold G. Davis. In this structure two members slidable longitudinally of the fire arm are provided on one of which is formed or mounted a front sight and on the other of which is the rear sight. The member carrying the front sight may be slid forward to extend beyond the muzzle of the fire arm, while the member carrying the rear sight may be moved rearwardly, thus nearly tripling the length of the sight base.

A somewhat novel form of gun stock pad is disclosed in patent No. 1,480,350, issued to George H. Martin and Albert V. Arnold. The pad is connected to the stock by a central pivot extending transversely with the stock, and an adjusting screw is provided above and below the pivot point so that the position of the pad may be varied to suit the user of the fire arm.

James Faller and Isaac Lapidus have produced a novel form of revolver on which they secured Letters Patent No. 1,480,521. This revolver consists of a case which may be held in the hand having a short barrel adapted to project between the fingers, and within the case is a rotary member having radial disposed cartridge chambers. The firing pin is locked at the center of the rotary member and is carried on a swinging lever which is swung to remote position by a thumb-pressed plunger.

Patent No. 1,481,042, issued to Fritz Walther and Georg Walther covers an automatic fire arm. In this fire arm the cartridges are fed by means of a slide block coupled to the breech block and traveling in a straight line in the receiver. A pin on the feed lever engages grooves in the slide block in such a manner that the feed lever is raised during the advance of the breech block and slide block to the position to feed the cartridge into the barrel; the cartridge is then pushed into the barrel by the advancing breech block.

Elmer A. Sperry has been granted patent No. 1,481,248 for an automatic sighting mechanism for aircraft guns. As recited in the patent, the principal objects of this mechanism are to provide means for shifting the sight with respect to the gun so that by keeping the sight on the relatively moving target the gun will be automatically pointed in such a manner to hit the target; also to provide means for obtaining the rate of change of relative bearing of a gun and its target and further to provide means for automatically deflecting the sight with respect to the gun for introducing a correction due to the velocity of the wind with respect to the gun mount.

In patent No. 1,482,062, granted to Carl Babbits there is shown a means for automatically swinging a machine gun in traverse or elevation to distribute the bullets discharged from the gun over a wide area. The means employed to secure this result consists of a series of gears operated by a reciprocating member of the gun. Some of the gears may be engaged or disengaged to secure a movement either in traverse or in elevation.

Zachariah E. Rice has secured patent No. 1,482,150, on a safety device for fire arms. This safety device may be attached to the ordinary safety lock on a fire arm and serves to indicate readily in a hammerless gun the position of the strikers.

Artillery

Arthur T. Dawson, Geo. E. Watt and Arthur L. Perham, assignors to Vickers Ltd., has secured patent No. 1,479,587, covering means for use in the laying of ordnance. The main object of this device is to eliminate errors in gun elevation caused by the axis to which the gun is trained not being truly vertical. Means are provided for correcting the errors arising from this cause when laying the gun in elevation.

An equilibrated breech block is covered by patent No. 1,479,697 granted to Prosper J. Charbonnier. The block is of the apertured type mounted to swing on horizontal trunnions and is swung to open and close position by means of a quadrant which engages a like quadrant carried by the breech block. The trunnions are supported upon knife edges mounted in the breech with a certain amount of play and are held by springs which tend to drive the same forward through the medium of bearing blocks against which the springs press.

A sighting means and method for projectile firing is covered by patent No. 1,479,840, issued to Andrew J. Stone, assignor to the Government of the United States. The inventor in this instance makes use of a rapid fire gun, a machine gun for instance, to locate the target, the machine gun and heavier gun being placed in certain known relation with respect to each other so that when the bullets from the machine gun have reached the target the heavy ordnance may be fired with assurance that its projectile will also strike the target.

Emile Rimailho, assignor to Compagnie Des Forges et Acieries de la Marine et D'Homecourt, has been granted patent No. 1,480,468, for a regulator for the outlet of liquid in artillery brakes. In this instance, the lifted outlet valve is varied inversely as the angle of elevation of the gun, thus for the higher elevations the valve is lifted a smaller amount.

A separable gun carriage is covered by patent No. 1,480,556, granted to Bryan P. Joyce of Rock Island Arsenal. This carriage is designed to accompany infantry and is so constructed that it may be readily knocked down for transportation.